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CONTENTS

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IN THIS ISSUE

Population statistics and related demographic data are being utilized to an increasing extent in the interpretation of the social and economic history of a country. Indeed, projections of recent demographic trends afford background information essential to forecasters of social and economic problems of a country. In the article "A Reconstruction of the Demographic History of Greece," Dr. Vasilios G. Valaoras has described a century of population growth and the effects of wars, migration, and other national crises on the demographic history of Greece. In spite of many deficiencies in the censuses of population and in the registration of births and deaths, Dr. Valaoras has been able to present reasonable estimates of the major population changes and has demonstrated the application of methods for overcoming the limitations in the data. It is of interest that both the death rate and the birth rate have decreased sharply since World War II and the indicated population growth of about one per cent per year does not suggest a population explosion in that country.

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For the past 25 years a conventional measure of the effectiveness of various types of contraceptive methods has been the number of pregnancies experienced per 100 years of contraceptive exposure to the risk of pregnancy. An implicit assumption of this method is that length of exposure *per se* is not relevant; more specifically there is the assumption that the sum of one-year exposures for 10 couples is equivalent to a 10-year exposure for one couple. In an article in this issue "Length of Observation Period As a Factor Affecting the Contraceptive Failure Rate," Dr. R. G. Potter, Jr., adduces both mathemati-

cal and empirical evidence that failure rates tend to be relatively high in short observation periods and relatively low in long observational periods. The variable "deserves high priority as a control in any comparative work." The implications of this study are not restricted to contraceptive data.

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Japan has attracted the attention of the world in her postwar economic recovery and also in her success at reducing both birth and death rates. This issue contains two research papers by Japanese authors whose names are well known in public health and demographic circles throughout the world. One of these is "Effect of Induced Abortion on the Reduction of Births in Japan," by Dr. Minoru Muramatsu. It is commonly known that induced abortions have been an outstanding means of reducing birth rates in Japan. Dr. Muramatsu has attempted to estimate the quantitative impact of induced abortion by a method described in the article. He finds that "the number of live births in 1955 in Japan would have amounted to twice (or more) the number actually registered if there had been no induced abortion at all."

Despite the major role of abortion and the relatively minor role of contraception in Japan, appreciable use of the latter type of family limitation has been made. Dr. Yosio Koya, formerly Director of the Institute of Public Health, and currently at the Nippon Medical School, has been a leader in his country in promoting demonstration clinics in family planning and measuring their effectiveness. In this issue he and his son, Dr. Tomohiko Koya, present a paper "The Prevention of Unwanted Pregnancies in a Japanese Village by Contraceptive Foam Tablets." Their report relates to the experience of 82 couples in a Japanese village who used contraceptive foam tablets at least one month during the four-year period of study, 1955–1958. The pregnancy rate during periods of use was less than one-fourth as high as the pregnancy rate during periods of non-use.

A RECONSTRUCTION OF THE DEMOGRAPHIC HISTORY OF MODERN GREECE

VASILIOS G. VALAORAS, MD., DR.P.H.[1]

INTRODUCTION

MODERN Greece has a long tradition of population statistics. Even before the new State was officially born, a population count was ordered in 1828, with the dual aim of enumerating the people of that year as well as that of 1821, i.e. the year when the War of Independence began. Eleven such enumerations were conducted in subsequent years until 1861, when the first real census—including population characteristics—was taken. It was followed by nine more complete censuses, spaced at irregular but close to ten-year intervals, the last one being taken in 1951. Similarly the registration of births and deaths was first instituted, on a country-wide basis, in 1860.

Paradoxically, this long demographic activity does not seem to have played an important role in the life of the Nation. Until very recently the Administration showed little interest in the work of the statistical organization, and statistical data were treated as mere historical facts and not as components for planning social and economic development. The failure to recognize the value of national statistics and population analyses as factors for general progress may account for the poor quality of the data and the long delays in the publication of statistics. Furthermore, repeated interruptions of the statistical work occurred in times of national crises, which struck Greece in the form of many wars or prolonged periods of political and economic unrest during the years under review.

Consequently, the stock of the background statistical material, which may serve as a basis for a study of the population

[1] Member of the United Nations Secretariat, New York. The views presented are his own and not necessarily those of the Secretariat.

of Greece and the evaluation of its past and future trends, is restricted to the following two series of data:[2]

1. The age-sex composition of the population, as found in the censuses of 1861, 1870, 1879, 1889, 1896, 1907, 1920, 1928, 1940 and 1951, and
2. the records of an intermittent registration of vital events, covering the periods 1860-1885, 1921-1940 and 1950 to date.

Unfortunately, there are both quantitative and qualitative limitations of the data, the most pronounced of which are those due to an incomplete count of the universe intended to be measured in each case. For example, all the censuses taken prior to 1920, show an unlikely preponderance of males, in spite of the fact that the preceding male emigration should have reduced the numbers of this sex appreciably. Similarly, an under-registration of vital events resulted in rates which for most of the period, are too low and not compatible with the trend of population development as depicted in the census series.

Imperfect as this set of population statistics may be, it nevertheless provides a way of approach toward gaining some insight into the real structure and dynamics of the population. This is achieved by interlocking the census data in their true perspective, so that cohort variations may be followed in chronological sequence. Thus, the juxtaposition of the age-sex composition of successive censuses, against the common year of birth of individual cohorts helps in depicting their true course, so that errors committed during the enumeration may be distinguished from real population changes. Additional help in this respect is derived from the sex ratios by age groups, which, under normal conditions, vary in a more or less standard pattern.

From a cursory examination of Figure 1 it may be seen that

[2] The schedules of the 1896 census were destroyed by fire before the sex-age structure of the population could be derived; the sex-age structure of the 1940 population was derived by a 10 per cent sample of the schedules which were later lost during the military occupation of the country. For sources *see:* Statistique Annuaire de la Grèce, 1930–1939; Statistical Yearbook of Greece, 1955–1957; and United Nations Population Studies No. 26; The Aging of Populations and its Economic and Social Implications. New York, 1957.

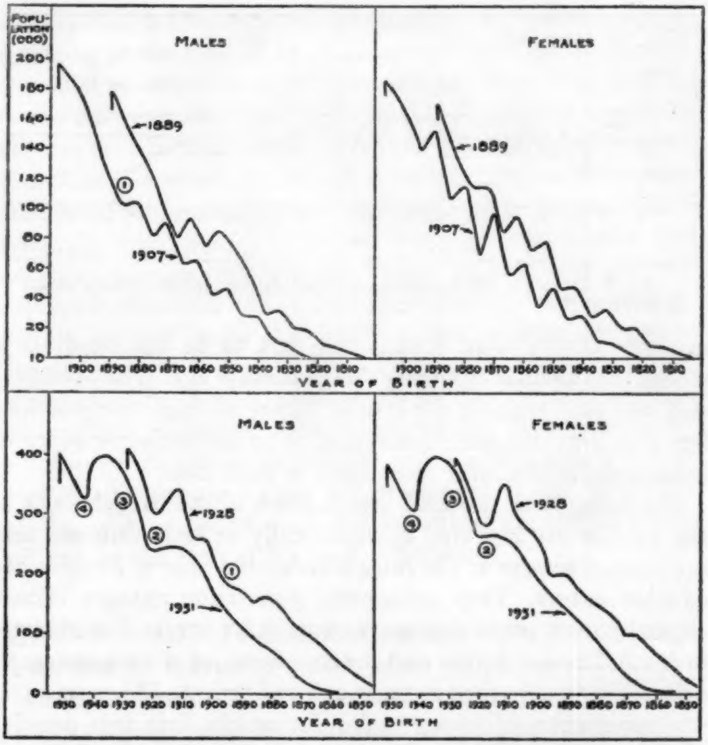


Fig. 1. Selected population profiles in quinquennial age groups. Greece, census returns of 1889, 1907, 1928 and 1951. (Circled numbers indicate abrupt population changes, *see* text.)

in addition to an obvious under-enumeration of the infant population in almost every census, at nearly all ages females were omitted on a much larger scale than males, in all censuses taken prior to the first World War. The reporting of age appears also to have been poor during this early period. The years of age ending in zero or five were strongly favored, especially for females, as is evident in the saw-edged profiles and the corresponding diagrams of sex ratios in Figure 2. Also, the thinning out of the male population in the ages around 20 years—that is the age group out of which the conscripts for

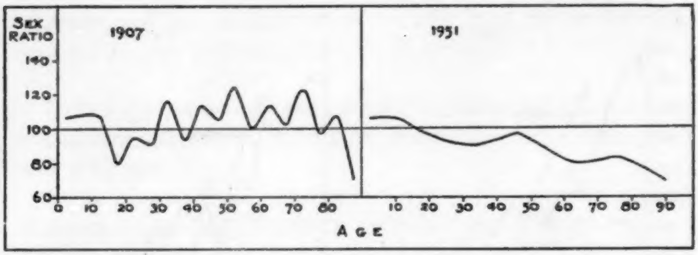


Fig. 2. Males per 100 females in quinquennial age groups. Greece, census of 1907 and 1951.

military service were chosen—appears to be the result of a strong bias against reporting this particular age. The presentation not only exposes the erratic nature of these irregularities but also provides some indication as to the probable order of magnitude of the error committed in each case.

Beginning with the 1907 census some of the irregularities in the profiles are repeated systematically in later censuses and are located *always at the same level as the year of birth of the affected cohort.* They reflect real population changes caused either by mass migratory movements or by severe disturbances in the balance of births and deaths. Some of these permanent deformities are marked in the graph and reflect: (1) mass overseas emigration of young males during the first two decades of this century, (2) decline of fertility during the five-year period prior to 1920, (3) accelerated fertility due to the influx of refugees in 1922–1924, and (4) a second curtailment of fertility which occurred during the second World War. As in the previous case, this presentation provides some indication as to the nature and the relative importance of the underlying demographic event, but that is the most one can get from reading the shape of successive population profiles.

A quantitative documentation of these population scars should be available from the returns of a registration system in which births, deaths, and migrants were promptly and accurately recorded. But none of the events mentioned above is substantiated by the relevant statistical data, since the regis-

tration system in Greece was either out of commission or poorly functioning at the time of their occurrence. In fact during the first period of enforcement of the registration of vital events, between the years 1860 and 1885, the quality of data produced never was very good and appears to have gradually deteriorated rather than improved. After a long interlude registration was resumed in 1921 but only after 1930 can returns be considered as virtually complete. The system collapsed again when the country was overrun by the Axis forces in 1941, and did not revive until after 1950. Thus, for the greater part of this period, including years of major demographic disturbances, the population of Greece was evolving in a vacuum, in which no direct information either on its trends or on its demographic mutilations could be obtained. The reconstruction of this more or less unknown demographic history and the filling in of some important demographic gaps are attempted in the following pages by making use of an indirect method developed a few years ago in the United Nations Secretariat.

The Method

The main feature of this method consists in the fact that age and sex specific mortality varies, under normal conditions, in an orderly manner and in direct association with the life expectancy of the population concerned.[3] A standardized expression of this variation may be found in a series of *survival ratios,* computed for a number of model stationary populations with a predetermined life expectancy at birth. (*See* Appendix Table I) Though the mortality trends of actual populations at a given time may not fit exactly any of the theoretical patterns, experience shows that in the long run the sequence of the various cohorts—in the absence of migration—follows closely the general trend described by this theory.

[3] Among the literature so far published in this respect *see:* United Nations, Age and Sex Patterns of Mortality, Model Life Tables for Underdeveloped Countries. New York, 1955, xii, 9; United Nations, Methods for Population Projections by Sex and Age. New York, 1956, xii, 3; Valaoras, V. G.: Standard Age and Sex Patterns of Mortaltiy. *In* Trends and Differentials in Mortality. New York: Milbank Memorial Fund, 1956, pp. 133–149; and Valaoras, V. G.: A Comparative Study of Actual Versus Stationary Populations. *Bulletin of the International Statistical Institute,* 36, part 2, pp. 198–217.

In applying this method to the population of Greece, the returns of successive censuses for each sex separately were first graduated by plotting the data in single years of age, against the scale of year of birth of corresponding cohorts. When only quinquennial age groups were available, a conversion to single-year data was obtained by graphical graduations. Most of the errors arising from misstatement of ages could be easily identified and, therefore, eliminated by suppressing fictitious deflections of successive profiles from their expected quasi-parallel course. At the same time errors due to under-enumeration of persons in certain age groups became evident, together with their location in the scale of age and also their approximate order of magnitude.

Correction of these errors was achieved with the finding of the appropriate survival ratios pertaining to the affected cohorts at the given chronological period. The search for a suitable series of survival ratios which could fit the observed inter-censal population changes, proceeded in the following manner: Quinquennial age groups of the first census were projected five or ten years later and those of the second census were retroceded accordingly, until the returns of each census were duplicated with parallel series of corresponding theoretical data. The series of survival ratios which gave the closest conformity with the census data was chosen as the most likely mortality pattern that affected the population during the given period. Maximum conformity was sought particularly among age groups which normally are not affected by significant migratory movements.

Once the mortality pattern pertaining to each period was decided upon, estimates of population by quinquennial age groups were computed for the first day of each calendar year ending in zero or five. The waning of the cohorts with advancing age could then be followed along the axis of time, thus providing a continuous flow of population estimates, by sex and age groups, within periods of unchanged area for the country as a whole. A break of this continuity occurred whenever the

national boundaries were extended to include newly liberated provinces. In these cases the newly added population could be roughly estimated by comparing the population data of the enlarged area against those expected to occur, had the area never changed.

Estimates were prepared independently for each sex but those for females were later adjusted in certain cases to conform with a more plausible sex ratio by age groups, in accordance with international experience. This operation was particularly needed in the case of the earlier censuses in order to rectify the obvious under-enumeration of the females. Also, by a simple reversal of the process, the number of live births out of which sprang the estimated number of children under the age of five years, was derived by applying the corresponding survival ratio to the first quinquennial age group.

Data on net migration can also be derived from the same method. Since the survival ratios are taken to express the effect of a normal mortality alone, any systematic deviation of the theoretical data from those obtained in the census, can result from either an abrupt change in the mortality pattern or a sizable migration. An example in this respect was first found in the 1907 census, where the male population in the age groups between 10 and 30 years was significantly smaller than that derived by the survival ratios. If the hypothesis of an excess mortality affecting exclusively these age groups while sparing the rest of the population, is dismissed, then a mass emigration of young male workers remains as the only reasonable explanation of this population loss, and history corroborates this finding.

In a similar way the volume of the refugee population which flooded the country in 1922-1924 and that of the war losses during the period 1940-1949 were computed by bringing the two marginal population, i.e. the population at the beginning and at the end of the period, into contact at a certain specified date. The difference obtained was taken to express the estimated population involved in each particular event. It is worth noting that such estimates are possible only if the demographic

disturbance is sandwiched between two fairly reliable censuses, the returns of which can serve as guiding points for the computations. The lack of relevant reference data prevented an estimate of the population changes which occurred between 1910 and 1920. Finally, the 1951 census population was projected into the near future, under the assumptions of a slowly declining fertility and a normal sequence in the series of survival ratios.

The reliability of this method depends on the overall accuracy of the basic census data and the correct selection of the mortality patterns which are brought into action in successive periods. Even if both these factors were unblemished, the result obtained might still differ from reality, since the individualities of a living population may vary beyond the rigid limits set up in an artificial model, whose main function is to give only linear trends of mortality. However, in the case of Greece, where official statistics are not adequate, the method enables one to enlarge substantially the existing body of population data, eliminate most of their inherent errors and fill in statistical gaps, thus restoring a more or less coherent demographic series for the entire period. With due regard to its limitations, the method provides a useful tool for supplementing fragmentary demographic series, and thus, assists in the study of insufficiently documented populations.

The Findings

A continuous series of population estimates for Greece by sex and age groups is given in Appendix Table II, and Figures 3 and 4, covering the period between 1860 and 1965. The result obtained, though not perfect, is undoubtedly more informative and of a better quality than the original data on which it was based. Because of a tightly interlocked system of relationships, most of the random or systematic errors of the various censuses are cancelled out of the processed data. Furthermore, the regular sequence of these estimates makes it possible to reconstruct sufficiently well the demographic history of the country, including some turbulent periods during which important demo-

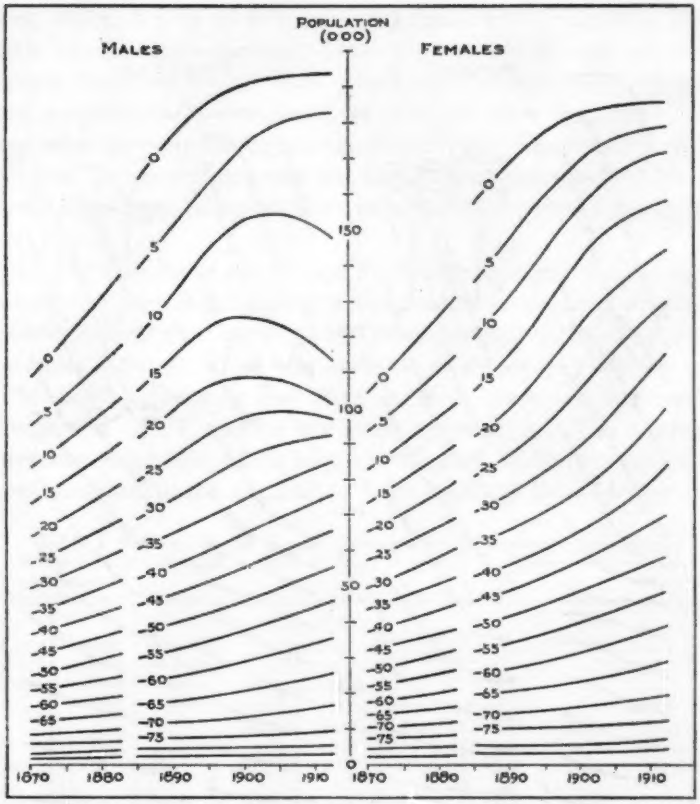


Fig. 3. Estimated population evolution by sex and age groups, Greece, 1870–1912. (0 = 0–4 years of age; 5 = 5–9 years; 10 = 10–14 years; etc.)

graphic events produced sharp deviations from the normal structure, and the dynamics of this population.

During this period the population of Greece underwent repeated and abrupt changes. The initial area of 47,516 square kilometers in 1860, grew to 132,562 in 1950, but this almost three-fold increase of the area was more than matched by a seven-fold increase of the total population. A large part of this increase—about 2.6 million persons—came as a result of the gradual integration within the national boundaries of sister

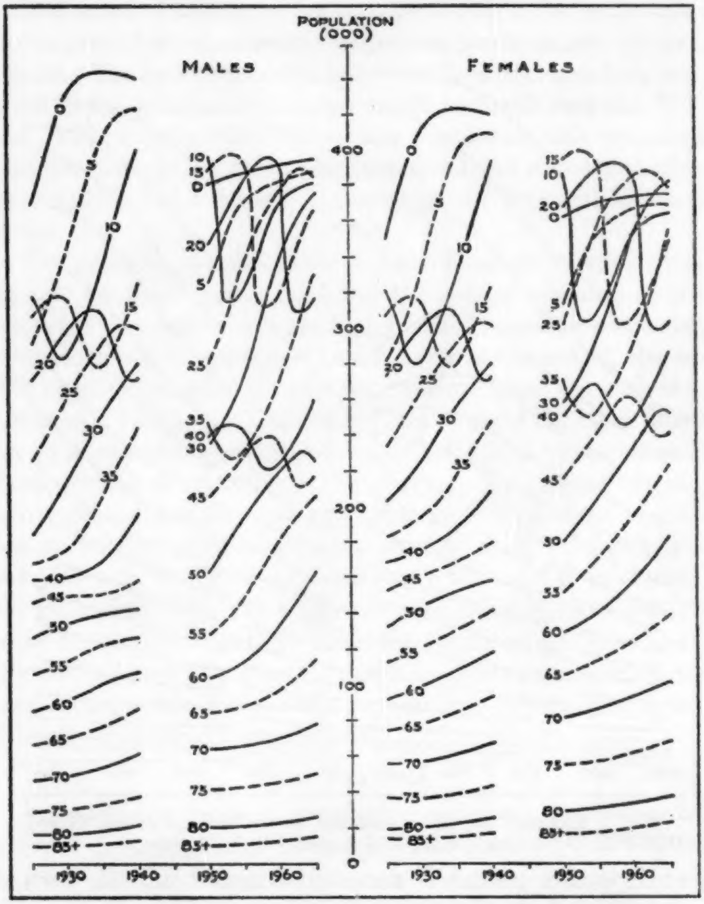


Fig. 4. Estimated population evolution by sex and age groups, Greece, 1925–1965. (0 = 0–4 years of age; 5 = 5–9 years; 10 = 10–14 years, etc.)

provinces previously under foreign domination. Furthermore the exchange of populations under the Treaty of Lausanne in 1923, brought into the country more than one million refugees from Asia Minor, Eastern Thrace, and Southern Bulgaria. Against these assets the population suffered repeated losses,

first, through a mass overseas emigration which depleted the male labor force in the early years of this century and, second, during the two World Wars which, for Greece lasted longer and proportionally cost more, in terms of lives lost, than for any other country taking part in these Wars. The combination of these events explains why the rate of population growth was never very high, being on the average slightly over 1 per cent per year.

1. *The Volume of the Abrupt Population Changes.* The estimated numbers of persons involved in some of the major population changes that occurred in Greece during this period, are given in Table 1. Thus, the addition of the Ionian Islands in 1864 and of Thessaly and Arta in 1881, increased the total population by 17 and 14 per cent, respectively. The intense overseas emigration which began at the turn of the century and continued unabated until after 1920, resulted by mid-year of

Table 1. Persons (in thousands) estimated to be involved in the specified population changes in Greece. (Year or period of reference is given in parenthesis.)

Age Groups	Ionian Islands Annexed in 1864	Thessaly and Arta Annexed in 1881	Cumulated Losses Due to Net Migration (June 30, 1912)		Refugee Immigration (1922–1924)		War Losses (1940–1949)	
			Males	Females	Males	Females	Males	Females
Total	200.2	254.3	222.9	29.3	537.9	576.3	490.0	354.5
0– 4	30.1	37.9	—	—	52.1	49.6	60.4	57.6
5– 9	24.2	32.0	—	—	54.8	53.4	103.5	100.5
10–14	20.5	25.9	27.4	2.0	56.0	55.2	25.7	24.7
15–19	18.4	22.6	53.0	8.8	53.8	53.9	23.7	12.2
20–24	16.6	19.7	51.9	9.2	50.5	51.6	47.6	20.6
25–29	14.8	17.8	39.0	6.4	46.6	48.5	41.4	23.5
30–34	13.1	16.1	25.4	2.9	40.7	45.2	35.3	24.4
35–39	11.6	14.7	14.6	—	35.0	41.1	31.9	22.1
40–44	9.5	13.6	7.2	—	31.4	36.3	28.5	17.0
45–49	8.8	11.5	3.2	—	27.7	31.7	22.9	12.6
50–54	7.4	11.6	1.2	—	23.7	27.6	17.7	8.5
55–59	6.4	8.2	—	—	19.3	23.4	13.5	6.9
60–64	5.2	7.8	—	—	15.6	19.6	10.6	6.2
65–69	4.7	5.8	—	—	12.8	15.2	9.0	5.8
70–74	3.7	3.9	—	—	9.3	11.8	7.3	5.0
75–79	2.7	2.5	—	—	5.3	6.7	5.7	3.8
80+	2.5	2.7	—	—	3.3	5.5	5.3	3.1

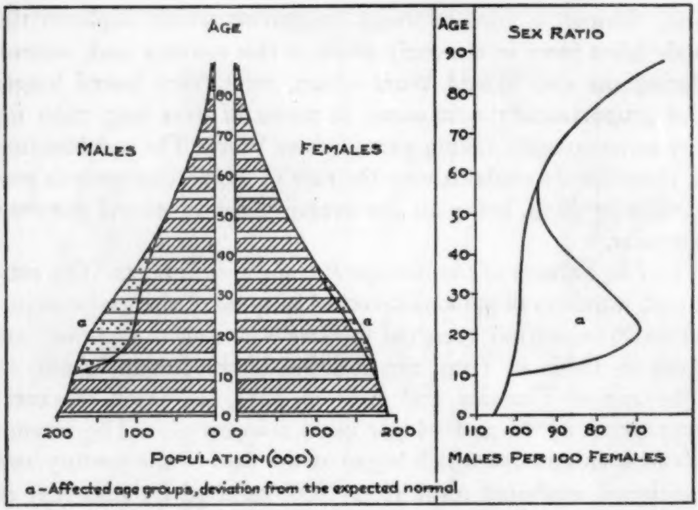


Fig. 5. Effect of emigration on the age structure and the sex ratio of the population of Greece, as of June 30, 1912. (a) = deviation from expected normal.

1912 in an 8.7 per cent reduction of the total population. No valid estimation of the total loss due to this emigration over its entire period of occurrence can be made at this time. However, its immediate effect upon the life of the nation appears to have assumed devastating proportions. Being highly selective as to sex and age groups, this emigration may be held responsible for the significant slackening of fertility and the general stagnation that afflicted the country, after the abortive war in 1897, until the beginning of the Balkan Wars in 1912. Figure 5 shows the large curtailment of the male population in the age group 15–40 and the dramatic disruption of the normal balance between the two sexes at this crucial age of the life span on which family formation and national production mostly depend.

Between 1912 and 1925, Greece experienced the most violent population changes in its history. Both the area and the population were more than doubled in the course of a long war which began successfully in 1912 and ended in defeat in 1922. Against

these gains, the population as a whole suffered considerable losses in addition to those caused by direct war action. In fact the data suggest a huge mortality among the civilian population, as the result of a widespread food shortage caused by an international blockade as well as of the influenza epidemic which swept the country in 1918–1919. Unfortunately, not even a rough estimate of the volume of these losses is possible, because quantitative data on any of the diverse factors involved are lacking.

The influx of refugees following the agreement on exchange of population between Greece, on the one hand, and Turkey and Bulgaria on the other, increased the 1925 population by 23 per cent. In the course of this heavy immigration, an unspecified number, probably a few hundred thousand, of persons of Turkish and Bulgarian extraction left the country. The settlement of such a formidable number of refugees, most of whom were completely destitute on their arrival, was almost too great to be borne by the frail economy of the small country. Nevertheless, the tenacity of the population together with some international assistance made it possible within a few years to turn this serious demographic adversity into a revitalizing factor that marks the beginning of a vigorous growth of both the population and the economic development of the country.

This turn of events was again interrupted by the second World War, which brought about a tripartite occupation of the country, a general famine, a prolonged communist uprising, and a systematic destruction of the national wealth. By 1950, the population was short by about 10 per cent of the expected total or, in actual numbers, by more than eight-tenths of a million (600,000 missing persons and 240,000 never born), because of excessive mortality, forced emigration and curtailed fertility.[4] Undoubtedly, the largest loss was caused by an acute

[4] A frequent cancellation of the menstrual cycle among females in the reproductive age, observed in Athens during the acute phase of the famine, indicated that temporary sterility was largely responsible for the significant decline of fertility. *See:* Valaoras, V. G.: Some Effects of the Famine on the Population of Greece. Milbank Memorial Fund *Quarterly*, July, 1946, xxiv, No. 3, pp. 215–234.

food shortage during the Axis occupation and the resultant general famine, which plagued the nation for more than two calendar years, but losses also were due to direct war action and forced emigration such as the abduction, in 1948-1949, of tens of thousands of young children by the retreating Communists.

2. *The Rate of Population Growth.* A summary of the principal population characteristics at five year intervals, since 1860, is given in Table 2. The average rate of population increase, computed on homologous populations within each period, was over 1.5 per cent per year prior to 1900. It declined

Table 2. Summary of principal population characteristics, Greece, 1860–1965. (Numbers in thousands). Dependency ratio: Dependents in the age groups under 15 and over 65, per 100 persons in the age group 15–64.

Year	Total Population (January 1st)	Per Cent Annual Increase[1]	Males per 100 Females	Population in Age Groups			Per Cent in Age Groups			Dependency Ratio
				0–14	15–64	65+	0–14	15–64	65+	
1860	1,103.8		99.4	426.9	631.6	45.3	38.7	57.2	4.1	74.8
1865[2]	1,372.4	1.24	99.2	525.4	782.8	64.2	38.3	57.0	4.7	75.3
1870	1,474.5	1.49	99.3	567.3	840.1	67.1	38.5	57.0	4.5	75.5
1875	1,593.0	1.61	99.3	618.1	904.1	70.8	38.8	56.8	4.4	76.2
1880	1,727.8	1.69	99.3	676.1	976.7	75.0	39.1	56.5	4.4	76.9
1885[3]	2,121.3	1.61	99.3	832.3	1,194.7	94.3	39.2	56.3	4.5	77.6
1890	2,294.1	1.63	99.3	906.8	1,288.8	98.5	39.5	56.2	4.3	78.0
1895	2,473.2	1.56	98.7	974.7	1,394.6	103.9	39.4	56.4	4.2	77.3
1900	2,632.3	1.29	96.0	1,022.3	1,499.9	110.1	38.8	57.0	4.2	75.5
1905	2,760.2	.97	92.5	1,050.2	1,593.0	117.0	38.1	57.7	4.2	73.3
1910	2,860.7	.73	88.7	1,057.9	1,677.3	125.5	37.0	58.6	4.4	70.6
1915	..	..	..	..	..	..	..	..	..	..
1920[4]	4,550.4		96.5	1,565.0	2,690.4	295.0	34.4	59.1	6.5	69.1
1925[5]	5,951.9	1.26	96.4	1,931.5	3,647.7	372.7	32.4	61.3	6.3	63.2
1930	6,408.0	1.53	97.0	2,086.9	3,929.3	391.8	32.6	61.3	6.1	63.1
1935	6,886.5	1.49	97.5	2,340.8	4,125.7	420.0	34.0	59.9	6.1	66.9
1940	7,363.2	1.38	97.8	2,492.4	4,402.1	468.7	33.8	59.8	6.4	67.3
1945	..	..	..	..	..	..	..	..	..	..
1950[6]	7,545.5		94.4	2,164.7	4,864.2	516.6	28.7	64.5	6.8	55.1
1955[7]	7,930.3	1.02	95.3	2,120.2	5,265.5	544.6	26.7	66.4	6.9	50.6
1960[7]	8,344.7	1.05	96.0	2,240.2	5,514.4	590.1	26.8	66.1	7.1	51.3
1965[7]	8,754.7	.98	96.6	2,274.9	5,819.5	660.3	26.0	66.5	7.5	50.4

Note: (. .) Data not available or not computed.
[1] Annual increase: average within period and same area.
[2] Territorial increase (Ionian Islands, annexed in 1864).
[3] Territorial increase (Thessaly and Arta annexed in 1881).
[4] Territorial increase (Epirus, Macedonia, Thrace, Aegean Islands and Crete, annexed in 1913–20). Indigenous population only, excluding persons later emigrated in exchange of refugees.
[5] Including refugees.
[6] Territorial increase (Dodecanese Islands annexed in 1947).
[7] Population projection.

sharply when the mass overseas emigration assumed substantial proportions, in spite of a still large biological balance resulting from the excess of births over deaths. Undoubtedly, this balance eventually had to follow the same downward trend, thus posing a serious question on the population's future, if these trends were to continue much longer. The outcome of the Balkan Wars enlarged considerably the demographic framework and although the migration losses continued for several more years, their effect upon the population became proportionally smaller.

However, the disastrous events which followed the first World War accentuated the decline in the rate of population increase, and may have stopped any increase. Only after the refugee immigration did the rate emerge again into a definitely positive phase, resuming, by 1930, its former level of 1.5 per cent per year. Since this turn of events was mostly due to the more prolific behavior of the refugees,[5] the gradual adaptation of these newcomers to the customs and the living conditions of the indigenous population resulted in a second decline of the rate of population growth which, in 1940, was at the level of 1.38 per cent. The rate fell again into a negative phase during the period of the second World War and then reversed to a slow upward trend to reach a level of about 1.0 per cent per year for the period after 1950.

3. *Sex and Age Composition.* The sex and age composition of the population also reflects its turbulent demographic history. Until the turn of the century both the sex ratio and the age composition were practically stable, with about 99 males per 100 females in the total population, a heavy proportion of children under 15 and very few old persons. Sizable deviations from this pattern began with the mass overseas emigration which reduced significantly the sex ratio and the proportion of children. As a result of subsequent events, most of which affected more males than females, even today the population of

[5] *See:* Valaoras, V. G.: The Demographic Problem of Greece and the Effect of the Refugee Immigration. Monograph in Greek, published in Athens, 1939.

Greece suffers from an unbalanced sex composition, and the male population in 1955 was short by about 150,000 persons from its expected normal number.

With respect to the age composition, an interesting trend had established itself with the consolidation of the population after the acclimatization of the refugees. On the eve of the Balkan Wars in 1912, the sex ratio dipped to the level of 87 males per 100 females and of every 100 persons there were on the average 36.5 children under the age of 15; 59.0 adults 15–64 years old and 4.5 old persons over the age of 65. The age composition was virtually the same in 1890, the three percentages were 39.5, 56.2 and 4.3, respectively. The proportion of children has subsequently been decreasing progressively while the proportion of the aged was increasing slowly. *See* Figure 6. In 1955 there were about 27 children and 7 old persons per 100 individuals of all ages, thus leaving a substantially increased balance of 66 persons in the working ages between 15 and 64 years. Such shifting in the age composition usually generates conditions which tend to favor the efficiency of the population. On the one hand it reduces the dependency burdens of the average family while on the other, it increases the volume of the potential labor force, thus promoting total productivity and economic development in general.

The relationship between "producers" and "consumers" is better illustrated in the so-called "dependency ratio," which expresses the number of dependents (those under 15 and over 65 years of age) per 100 persons in the age brackets of 15 to 64. Since the labor force is drawn from this last group of men and women in the working age, any change favoring this group at the expense of the other, is likely to bring forth an accelerated production, an increase in the volume of capital formation and a betterment of the level of living in general.

Up to the turn of the century there were 75 or more dependents per 100 persons in the working ages, a ratio obviously too high to allow for significant improvements in the levels of living. Because of the presence of a relatively large number of

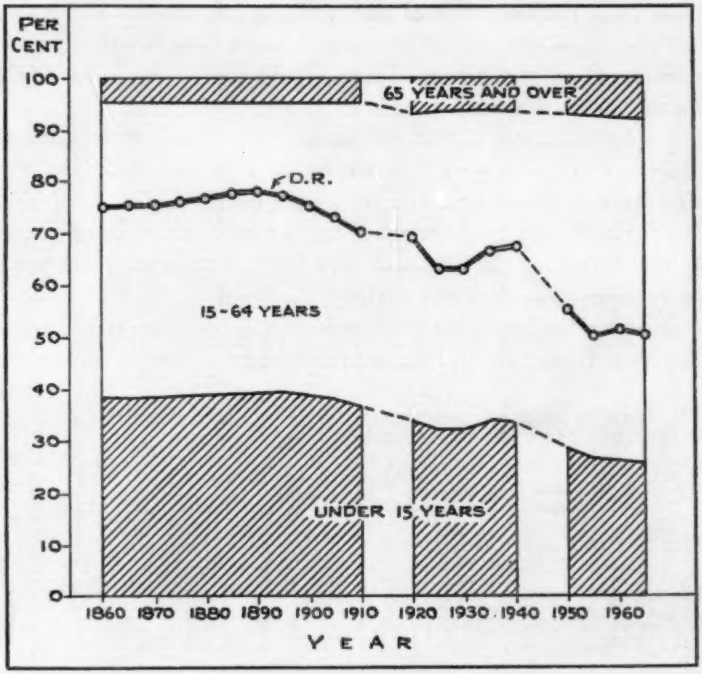


Fig. 6. Age composition of population and dependency ratio (D.R.), Greece, 1860–1965.

children, the energy of the "producers" was spent almost entirely in meeting the primary needs for food, shelter, and clothing, with little or no margin left for activities on which material expansion mostly depends. This margin was further reduced during the period of emigration, as it depleted heavily the most potent segment of the labor force, i.e. the male workers between the ages of 15 and 40 years. Only after the settlement of the refugees in 1930, did a lessening of the dependency burdens become evident and only after 1950 was this ratio reduced to a level of about one dependent for each man of the working age.

These changes in the age composition reveal a trend toward population maturity, which sometimes is taken as a prerequisite of economic development. This "maturity" is the

result of a prolongation of the working life on the one hand, and the abandonment of a wasteful pattern of population replacement, on the other. These changes may be followed in the trends of the vital rates.

4. *The Vital Rates.* As one might expect, the crude rates of births and deaths were fluctuating at high levels during the early part of the period, but later they declined rather rapidly. *See* Table 3. Until the turn of the century, there were about 40 live births against 25 deaths per 1,000 population each year. Both these rates declined slightly during the period of intense emigration, and probably crossed each other abruptly during the second decade of this century. The interwar period is

Table 3. Estimated annual numbers (average within each quinquennial period) and approximate rates of vital events, Greece, 1860–1965.

Period	Estimated Numbers (000)						Rates				Life Expectancy at Birth (Both Sexes)
	Mid-Period Population	Live Births	All Deaths	Excess of Births	Infant Deaths	Net Migration	Live Births	All Deaths	Infant Deaths	Gross Reproduction[1]	
1860–64	1,138.0	43.9	30.2	13.7	8.7	—	38.6	26.5	198.2	..	35.7
1865–69	1,423.4	55.7	35.3	20.4	11.0	—	39.1	24.8	197.5	..	35.9
1870–74	1,533.7	61.1	37.4	23.7	12.0	—	39.8	24.4	196.4	..	36.2
1875–79	1,660.4	67.1	40.1	27.0	13.0	—	40.4	24.2	193.7	..	36.6
1880–84	1,797.4	73.3	45.5	27.8	14.0	—	40.8	25.3	191.0	..	37.1
1885–89	2,207.7	89.1	54.6	34.5	16.7	—	40.4	24.7	187.4	..	37.7
1890–94	2,383.9	93.0	55.6	37.4	17.0	− 1.6	39.0	23.3	182.8	..	38.5
1895–99	2,552.7	94.7	55.6	39.1	16.8	− 7.3	37.1	21.8	177.4	..	39.4
1900–04	2,696.2	95.0	55.5	39.5	16.4	−13.9	35.2	20.6	172.6	..	40.4
1905–09	2,810.4	94.5	57.1	37.4	15.7	−17.3	33.6	20.3	166.1	..	41.2
1910–14	..	..	..	..	..	..	..	..	..	..	..
1915–19	..	..	..	..	..	..	..	..	..	..	..
1920–24[2]	4,694.5	147.2	99.7	47.5	21.8	..	31.4	21.2	148.1	..	45.2
1925–29	6,180.0	200.5	107.7	92.8	26.5	− 1.6	32.4	17.4	132.2	2.31	48.2
1930–34	6,647.2	201.9	110.0	91.9	24.6	+ 3.8	30.4	16.6	121.8	2.12	50.3
1935–39	7,124.8	196.7	103.8	92.9	21.4	+ 2.4	27.6	14.6	108.8	1.88	52.8
1940–44	..	..	..	..	..	..	..	..	..	..	..
1945–49	..	..	..	..	..	..	..	..	..	..	..
1950–54	7,724.4	163.2	77.2	86.0	8.7	− 9.0	21.1	10.0	53.3	1.34	62.1
1955–59	8,124.0	162.0	77.2	84.8	6.8	− 1.9	19.9	9.5	42.0	1.21	65.0
1960–64	8,549.7	161.1	78.0	83.1	6.0	− 1.0	18.8	9.1	37.2	1.16	66.6

Notes: All data refer to population within the same area as in the initial year of each period. (—) Quantity nil or near zero. (..) Not computed.

[1] Computations of GRR; period 1925–1940: in accordance with distribution of birth by age of mother of year 1928; period 1950–1965: in accordance with that of 1956.

[2] All numbers refer to population within the area of the Treaty of Lausanne but excluding population exchanged between 1922–1924.

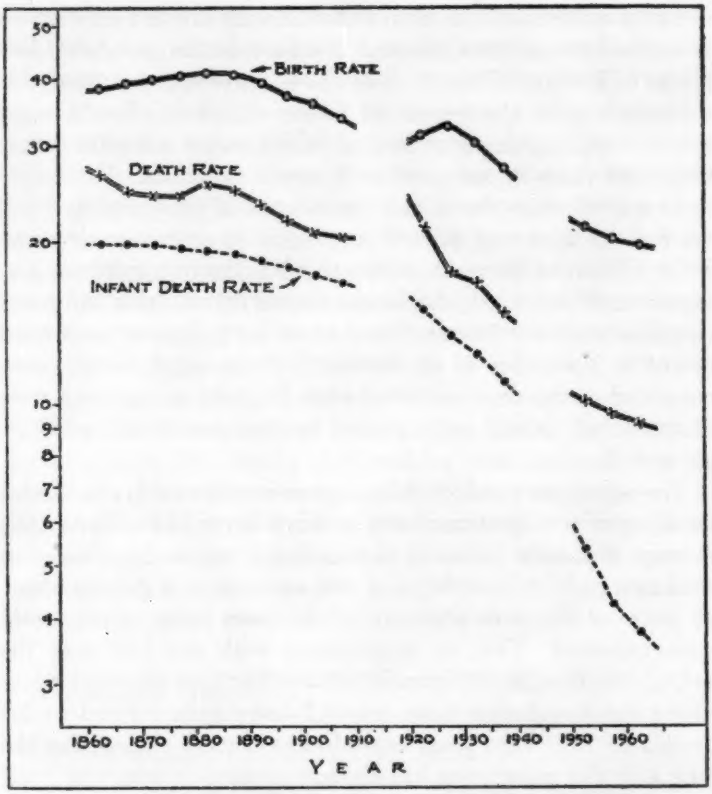


Fig. 7. Estimated birth and death rates per 1,000 population and infant death rates per 100 live births, Greece, 1860–1965. (Semilogarithmic scale.)

marked by a swift decline of mortality accompanied by a smaller reduction of fertility. After a temporary reversal of these trends during World War II, the decline was resumed in the years after 1950 from the level of about 20 live births and 10 deaths per 1,000 population. *See* Figure 7. In spite of these declines there still is an ample margin of population increase—some 80,000 persons per year—which in terms of life potentials can sustain an expanding economy more efficiently than the slightly larger increase which characterized the pre-war period.

The more refined rate of infant mortality shows a continuous downward trend from about 200 infant deaths per 1,000 live births in 1860, to about 45 in 1955. It represents a remarkable achievement of the people of Greece in their effort toward raising their standards of health, which today compare favorably with those of many other Western countries. The battle against premature death and the control of preventable death are well on their way toward success, as an overwhelming majority of deaths (more than two-thirds) now occur among persons over 50 years old, and deaths caused by infective and parasitic diseases have been reduced to an insignificant proportion of about 5 per cent of all deaths. Twenty years earlier, only one-third of the deceased were over 50 years of age, and one-fourth of all deaths were caused by diseases which could be prevented.

The aggregate result of this progress is reflected in the virtual doubling of the life expectancy at birth since 1860. Today the average new-born infant in Greece has a reasonable chance to celebrate its 65th birthday and this amounts to a gain of about 15 years of life over what an infant, born before 1940, could have expected. This, in combination with the fact that the average mother, in 1955, could achieve her task toward replenishing the population with only 1.2 baby girls instead of 2.1 needed in 1935 (the gross reproduction rates) exemplifies the long way this population has already covered in adapting itself more efficiently to the potentialities of its environment.

Comparison of these estimates with the official data may throw some light on the reliability of the method used. Reference to the limitations and the advantages of this method was made earlier. From this it may be deduced that while strict conformity between registered and theoretical data cannot always be expected, general levels and trends should agree with each other within a small margin of deviation. With these qualifications in mind an approximate estimate of the completeness of the registration of births and deaths is shown in Table 4.

Allowing for a margin of about 5 per cent error in the series

of the estimated rates, the overall variability of the completeness of the registration of vital events in Greece turns out to be as expected, save for the period after 1950. For this period it is difficult to explain why births are reasonably well registered while the registration of deaths is lagging far behind the expectation. A death rate higher than the official is nevertheless suggested by the tabulation of deaths by provinces as well as by the mid-year official population estimates by sex and age groups, already published for 1955 and 1956. Furthermore, since 1954, when the new Statistical Service of Greece began its full-scale operation, the annual numbers of deaths appear to be on the increase. Whether this is an indication of an improving coverage of deaths or whether other factors are responsible for this discrepancy is a matter for further research. In the meantime the results obtained by this analysis may be taken as a first approximation of the demographic history of Greece over the last 100 years. It tells a story of violent demographic reverses and interesting recoveries, which, in spite of the country's long tradition of population statistics, was little known in its main composites or its overall trends.

Table 4. Comparison between registered and estimated birth and death rates, in Greece, 1860–1957.

Period	Birth Rate			Death Rate		
	Registered	Estimated	Per Cent Registered	Registered	Estimated	Per Cent Registered
1860–64(a)	28.7	38.6	74.4	20.6	26.5	77.7
1865–69	29.0	39.1	74.2	21.3	24.8	85.9
1870–74	28.3	39.8	71.1	21.1	24.4	86.5
1875–79	27.6	40.4	68.3	19.0	24.2	78.5
1880–84	23.1	40.8	56.6	16.8	25.3	66.4
1885–89(b)	34.7	40.4	85.9	24.3	24.7	98.4
1920–24(c)	20.2	31.4	64.3	15.6	21.2	73.6
1925–29	29.3	32.4	90.4	16.3	17.4	93.7
1930–34	30.0	30.4	98.7	16.6	16.6	100.0
1935–39	26.5	27.6	96.0	14.4	14.6	98.6
1950–54	19.4	21.1	91.9	7.2	10.0	72.0
1955–59(d)	19.4	19.9	97.5	7.4	9.5	77.9

Registration Period: (a) 1860, 1861 and 1864.
(b) 1889 and 1890 (provisional data.)
(c) 1921–1924.
(d) 1955–1957.

Conclusions

Some 130 years ago Greece, a tiny nation of not more than three-quarters of a million persons, began to shape its newly-won statehood, while eking out a poor livelihood in the midst of terrific odds. The time of one full generation was spent in the first *formative* stage, at the end of which the population reached one million. However, demographic data were practically non-existent and it is difficult to determine how much of that population increase was due to the return of former expatriates and how much to natural increase.

A second stage, that of a *mounting population pressure and territorial expansion,* began after 1860 and proceeded slowly until the second decade of this century, when the area and the population of Greece grew abruptly to more than double their former size. During most of this period and more specifically between 1880 and 1912, the pressure of a moderately growing population upon its limited resources, became increasingly evident. The chronic unemployment, wide-spread poverty, and social apathy were only partially alleviated by a mass overseas emigration. The basic problem was that of a growing disequilibrium between population and resources. It was only as a result of the subsequent territorial expansion and of a rudimentary industrial development, that a new outlook emerged and that further demographic deterioration of possibly grave national consequence was halted.

During the latter part of the inter-war period this population entered into its third stage of development, which may be labelled as one of *progressive maturity*. Notwithstanding the repeated setbacks suffered during this period, the population was gradually becoming more efficient in its age composition and its objectives, while the economy was oriented toward more realistic plans of development. New industries and skills were created under the impact and the stimulus of the many needs, which still were not fully met, and agricultural output was pushed to levels not hoped for a generation ago. The small

nation is now striving along a difficult road leading to a relative prosperity for its people.

Appendix Table 1. Cohort survival ratios derived from model populations at different levels of life expectancy at birth, by sex. (BS: both sexes; M: males; F: females.)

Cohorts \ e:	BS: 35.0		BS: 50.0		BS: 65.0	
	M: 34.1	F: 35.7	M: 48.4	F: 51.4	M: 63.2	F: 66.6
Birth to 0– 4	.7470	.7646	.8468	.8667	.9413	.9528
0– 4 to 5– 9	.8713	.8725	.9405	.9433	.9850	.9873
5– 9 to 10–14	.9620	.9607	.9829	.9834	.9938	.9949
10–14 to 15–19	.9633	.9605	.9815	.9817	.9924	.9941
15–19 to 20–24	.9529	.9487	.9737	.9740	.9890	.9909
20–24 to 25–29	.9437	.9405	.9685	.9690	.9869	.9884
25–29 to 30–34	.9348	.9346	.9655	.9664	.9856	.9869
30–34 to 35–39	.9266	.9282	.9616	.9636	.9832	.9846
35–39 to 40–44	.9172	.9211	.9551	.9596	.9779	.9812
40–44 to 45–49	.9043	.9127	.9448	.9535	.9688	.9755
45–49 to 50–54	.8859	.9016	.9289	.9433	.9546	.9660
50–54 to 55–59	.8583	.8840	.9040	.9257	.9333	.9513
55–59 to 60–64	.8147	.8534	.8657	.8949	.9009	.9270
60–64 to 65–69	.7502	.7996	.8089	.8425	.8528	.8871
65–69 to 70–74	.6603	.7217	.7239	.7650	.7836	.8212
70–74 to 75–79	.5444	.6188	.6122	.6606	.6865	.7239
75–79 to 80–84	.4104	.4856	.4843	.5342	.5603	.5980
80–84 to 85–89	.2656	.3386	.3418	.3901	.4155	.4477

As of January First	Sex	All Ages	Age Groups						
			0–4	5–9	10–14	15–19	20–24	25–29	30–34
1965[1]	M	4,302.5	394.0	388.8	381.2	368.0	317.3	384.0	375.6
	F	4,452.2	375.2	371.1	364.6	352.5	306.7	377.0	382.4
1960[2]	M	4,087.5	392.9	383.1	370.3	320.2	388.2	380.0	335.7
	F	4,257.2	374.2	365.7	354.0	308.8	380.3	386.3	357.7
1955	M	3,869.0	388.7	372.5	322.6	392.4	384.9	340.4	272.9
	F	4,061.3	370.2	355.7	310.5	383.6	390.6	362.2	297.5
1950[3]	M	3,663.2	380.8	325.3	396.2	390.4	346.2	278.0	234.5
	F	3,882.3	362.7	312.8	386.9	395.5	367.9	302.8	258.0
1940	M	3,641.5	441.0	423.3	403.3	328.4	272.7	299.7	280.2
	F	3,721.7	420.0	409.0	395.8	326.4	273.5	302.1	283.0
1935	M	3,399.5	444.5	409.3	335.8	279.1	308.2	289.0	252.4
	F	3,487.0	423.3	397.4	330.5	278.4	309.7	292.2	256.8
1930	M	3,155.0	434.0	341.5	284.2	316.3	298.1	261.2	214.6
	F	3,253.0	413.3	332.8	281.1	316.2	300.5	264.9	225.7
1925[4]	M	2,921.2	365.7	289.6	322.8	306.7	270.3	222.8	184.0
	F	3,030.7	348.3	283.6	321.5	307.6	273.3	234.0	202.9
1920[4]	M	2,234.9	257.4	275.3	259.6	229.1	183.6	149.6	139.7
	F	2,315.5	245.2	269.1	258.4	226.6	191.9	163.9	150.4
1912[5]	M	1,347.5	193.7	182.6	147.4	113.1	100.4	96.8	92.0
	F	1,554.4	185.0	178.1	170.9	157.1	143.9	130.5	115.7
1910	M	1,345.0	193.4	182.1	150.5	117.1	103.9	98.4	91.4
	F	1,515.7	184.7	177.7	169.5	155.7	141.4	126.4	110.3
1905	M	1,326.0	192.7	179.6	153.9	122.5	107.5	99.0	89.1
	F	1,434.2	184.0	175.2	164.8	150.3	133.6	116.3	99.4
1900	M	1,289.4	190.3	173.2	152.1	124.2	108.9	98.0	86.7
	F	1,342.9	181.8	169.0	155.9	141.2	123.2	105.0	89.3
1895	M	1,228.5	185.5	163.2	145.6	122.5	106.7	94.1	80.5
	F	1,244.7	177.2	159.2	144.0	127.4	110.3	94.9	81.3
1890[6]	M	1,143.3	176.6	150.9	132.4	114.9	99.4	86.2	74.6
	F	1,150.8	168.7	147.2	131.0	114.8	99.9	86.9	75.3
1885[6]	M	1,057.0	163.9	138.5	119.8	104.4	91.2	79.9	69.7
	F	1,064.3	156.5	135.1	118.5	104.3	91.7	80.5	70.4
1880	M	861.0	131.6	112.6	98.7	86.5	75.5	65.9	57.3
	F	866.8	125.7	109.9	97.6	86.4	75.9	66.4	57.9
1875	M	793.7	119.5	103.3	90.7	79.9	69.7	61.0	53.2
	F	799.3	114.1	100.8	89.7	79.8	70.1	61.5	53.7
1870[7]	M	734.5	108.7	95.4	83.6	73.7	64.8	56.7	49.3
	F	740.0	103.8	93.1	82.7	73.6	65.1	57.2	49.8
1865[7]	M	683.4	100.8	88.1	77.5	68.2	60.1	52.9	46.2
	F	689.0	96.3	86.0	76.7	68.1	60.4	53.3	46.7
1860	M	550.3	81.3	71.8	63.4	55.5	49.0	43.2	37.6
	F	553.5	77.7	70.0	62.7	55.4	49.2	43.5	38.0

Appendix Table II. Estimated population (in thousands) of Greece by sex and age groups, 1860–1965.

[1] Projections based on 1951 census and official estimates for 1955 and 1956.
[2] Including Dodecanese Islands, annexed in 1947.

Age Groups										
35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+
331.1	263.5	218.4	226.6	206.0	164.3	115.9	77.6	49.1	26.1	15.0
353.4	288.6	243.0	251.7	224.8	184.6	141.5	103.3	69.2	38.6	24.0
268.5	224.6	236.4	219.6	181.3	134.9	98.0	70.4	45.6	24.3	13.5
293.1	248.3	259.5	235.2	197.8	158.0	124.2	93.9	63.1	35.3	21.8
229.5	243.8	229.8	194.1	149.6	114.7	89.6	66.2	43.2	21.9	12.2
252.9	265.8	243.2	207.7	170.2	139.7	114.0	86.8	58.7	32.3	19.7
250.6	238.5	204.5	161.4	128.4	106.2	85.9	64.5	40.4	20.3	11.1
272.1	250.5	216.2	180.1	152.1	130.3	107.6	82.9	55.6	30.1	18.2
243.8	197.3	160.3	141.7	126.8	107.4	86.6	60.5	36.2	20.2	12.1
249.0	211.0	180.5	159.0	140.9	118.4	95.4	68.8	43.9	26.4	18.6
206.6	168.8	151.7	139.3	122.6	100.8	76.8	52.9	32.4	18.1	11.2
218.2	188.0	169.3	152.4	132.7	109.5	85.6	61.8	40.0	23.9	17.3
176.5	160.4	149.8	135.4	114.5	91.9	70.1	48.9	30.8	16.3	10.5
195.5	177.0	162.6	145.0	122.7	100.5	79.8	58.3	38.9	21.9	16.3
168.4	159.1	146.3	127.1	106.6	85.1	66.3	46.2	29.2	15.1	9.9
185.1	170.9	154.8	134.1	114.4	94.2	76.6	56.0	37.4	20.5	15.5
134.1	126.0	111.4	96.3	79.5	63.7	51.8	35.3	22.0	12.1	8.4
141.0	130.5	114.6	100.2	85.7	72.6	62.0	44.5	29.1	16.9	12.9
84.8	75.6	65.3	55.1	45.9	35.6	25.7	16.4	9.5	5.1	2.5
100.7	84.3	70.4	58.6	48.7	38.7	29.1	19.5	12.1	7.1	4.0
83.2	73.6	63.5	53.3	43.8	34.1	24.4	15.7	9.1	5.0	2.5
94.8	79.7	67.1	56.0	46.5	37.1	27.6	18.7	11.6	6.9	4.0
79.2	68.8	59.4	49.7	40.4	31.4	22.5	14.5	8.6	4.8	2.4
84.6	71.6	61.3	51.8	42.9	34.2	25.5	17.2	10.9	6.7	3.9
75.1	64.4	54.8	45.9	37.3	28.9	20.8	13.6	8.3	4.6	2.3
76.3	65.6	56.3	47.8	39.6	31.4	23.6	16.2	10.6	6.4	3.7
69.4	59.5	50.7	42.6	34.6	26.8	19.4	12.7	8.1	4.4	2.2
70.3	60.6	52.1	44.4	36.7	29.2	22.0	15.1	10.3	6.1	3.6
64.6	55.3	47.3	39.6	32.1	25.0	18.2	12.1	7.8	4.2	2.1
65.5	56.3	48.6	41.2	34.1	27.2	20.6	14.4	9.9	5.8	3.4
60.6	51.9	44.3	37.1	29.7	23.5	17.1	11.8	7.6	4.0	2.0
61.4	52.9	45.5	38.6	31.5	25.6	19.4	14.0	9.7	5.5	3.2
49.6	42.1	35.8	29.3	23.9	18.4	13.5	9.5	6.2	3.2	1.4
50.2	42.9	36.8	30.5	25.4	20.0	15.3	11.3	7.9	4.4	2.3
45.8	39.2	32.9	27.3	22.2	17.1	12.6	9.1	5.9	3.0	1.3
46.4	39.9	33.8	28.4	23.6	18.6	14.3	10.8	7.5	4.2	2.1
42.9	36.5	30.8	25.3	20.6	15.9	12.0	8.7	5.6	2.8	1.2
43.5	37.2	31.7	26.3	21.9	17.3	13.6	10.3	7.1	3.9	1.9
40.0	33.8	28.6	23.9	19.2	15.1	11.6	8.4	5.3	2.6	1.1
40.5	34.4	29.7	24.9	20.4	16.4	13.1	10.0	6.7	3.6	1.8
32.3	27.3	23.1	19.0	14.9	11.4	8.5	5.8	3.8	1.7	0.7
52.7	27.8	23.7	19.8	15.8	12.4	9.6	6.9	4.8	2.4	1.1

[3] Including refugee population arrived in 1922–1924.
[4] Including Epirus, Macedonia, West Thrace, Aegean Islands and Crete but excluding Moslems and other populations, later exchanged for the refugees.
[5] As of June 30th, 1912.
[6] Including Thessaly and Arta, annexed in 1881.
[7] Including Ionian Islands, annexed in 1864.

LENGTH OF THE OBSERVATION PERIOD AS A FACTOR AFFECTING THE CONTRACEPTIVE FAILURE RATE

R. G. Potter, Jr.[1]

Introduction

THE protection which a group of couples receive from contraception is conventionally measured by the number of pregnancies experienced per 100 years of contraceptive exposure. To compute this rate one must first determine for each couple their number of contraceptive failures as well as the number of months they practiced contraception when there existed a risk of pregnancy. These contraceptive failures and months of contraceptive exposure are then summed for the total group and a pregnancy rate computed by the following formula:

$$\frac{\text{total number of contraceptive failures} \times 1200}{\text{total months of contraceptive exposure}}$$

Naturally one may use this failure rate to compare the contraceptive performances of two groups. But a frequent error is to infer more than is justified. Suppose that contraceptive failure rates have been computed for two independent random samples and that Sample A exhibits a lower rate than Sample B. If the difference is large enough to dismiss sampling variability as a plausible explanation, then one is entitled to infer that probably the couples of Population A are enjoying a lower pregnancy rate during contraception than members of Population B. But unless certain controls have been built into the comparison of Samples A and B, one is not justified in going further to attribute this lower pregnancy rate to more efficient contraception.

To justify this additional inference, several controls are cru-

[1] Office of Population Research, Princeton University. The writer is indebted to Doctors F. W. Notestein, P. C. Sagi, and C. Tietze for many helpful comments and to Mrs. E. Harm for her computational work.

cial. For example, it is essential that the two samples be similar in fecundity, that contraceptive failures be uniformly defined for both groups, and that postpartum amenorrhea and anovulatory cycles be as successfully eliminated from the contraceptive exposures of one sample as the other. An especially difficult problem of control is minimizing the number of couples lost before the end of the study for such reasons as changed address or disinterest in the investigation. The importance of controlling these several factors is widely recognized. What is not generally appreciated, however, is the need for standardizing the length of the observation period. As will be shown, the same sample observed for a longer period exhibits a lower failure rate.

The objective of this paper is to demonstrate that the contraceptive failure rate is sufficiently sensitive to the length of the observation period so that this factor deserves high priority as a control in any comparative work.

A Model

Before illustrating empirically how sensitive the contraceptive failure rate is to differing lengths of observation period, it is worthwhile to explore, by means of a simplified model, the conditions under which this sensitivity is greater or less. A nonprobabilistic model will be used which draws upon, but also generalizes, certain features of a model recently published by C. Tietze.[2]

In the present model, it is assumed that a large group of couples, starting contraception at the same time, are observed for "t" months. During this observation period, all couples continue practicing contraception unless interrupted by an unplanned pregnancy. Hence their contraceptive exposures either equal "t" months, if they succeed in avoiding pregnancy during the observation period, or else equal the smaller number of months preceding contraceptive failure. It is assumed that contraceptive exposures do not include any months of post-

[2] Tietze, C.: Differential Fecundity and Effectiveness of Contraception. *The Eugenics Review*, January, 1959, 50, No. 4.

partum amenorrhea. Also, none of the couples is lost to the study before the end of the observation period for such reasons as changed address or ceasing to cooperate.

Other simplifying assumptions pertain to the monthly risk of contraceptive failure. Specifically it is assumed that this monthly risk of pregnancy during contraceptive exposure varies among couples but is constant for a single couple. Moreover, a couple's constant risk of unplanned pregnancy is interpreted as a product of two values. First is the couple's fecundability, or monthly likelihood of pregnancy in the absence of contraception. Second is their "contraceptive efficiency," or the percentage reduction they are effecting in their monthly likelihood of pregnancy by practice of contraception. For example, if their contraception is .9 efficient, they are lessening their chance of pregnancy to .1 of its original value in the absence of contraception. Hence, if their fecundability is .5 say, their monthly risk of pregnancy with contraception becomes .1(.5) or .05.

For purposes of the model it is very important that the distribution of fecundabilities be made as realistic as possible. Considerable pains have been taken to derive a distribution of fecundabilities that is plausible for urban United States. The distribution of fecundabilities is graphed in Figure 1. On the assumption that no contraception is being practiced, this distribution yields a set of pregnancy delays which closely match those of a criterion sample of successful contraceptors after deliberately stopping contraception in order to become pregnant. This criterion sample is based on successful contraceptors from the Indianapolis Study and from a large, unselected group of obstetric patients of Baltimore. Together these two series afford perhaps the best data of this type available for urban United States.[3] The fit between model and empirical standard is given in Table 1.

[3] Tietze uses the same empirical standard and for details the reader is referred to his article, *ibid.*, p. 231. Using this standard, Tietze derives a distribution which allocates couples 60:38:2 among fecundabilities of .50, .10, and .01. This 3-point distribution of fecundabilities has computational advantages over the continuous distribution adopted in the present article, but yields a poorer fit with the empirical standard.

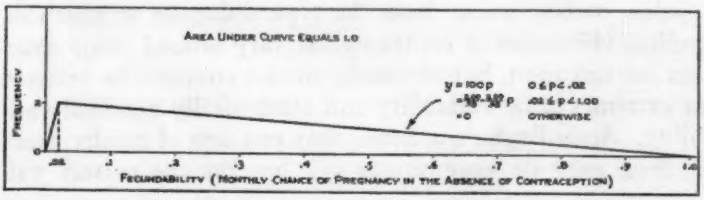
Source of Pregnancy Delays	Percentages of Pregnancies Occurring after Delays of:						
	One Month	2–3	4–6	7–12	13–24	Over 24	Total
Criterion Sample	34.0	27.7	16.3	10.7	5.4	5.7	99.8
Hypothetical Distribution	34.0	27.3	15.1	11.8	5.7	6.1	100.0

Table 1. Comparison of pregnancy delays generated by hypothetical distribution of fecundabilities with those observed in criterion sample.

It is seen from Figure 1 that the distribution of fecundabilities has the form of an asymmetrical triangle. Thus the distribution is continuous except for one point of discontinuity at .02. The fecundabilities of this hypothetical distribution have a standard deviation of .23 and a mean value of .34, this mean corresponding to the proportion of pregnancies occurring in the criterion sample the first month after stopping contraception. From a peak density at .02, the frequency of fecundabilities decreases progressively toward the limits of zero and unity where the frequency becomes zero. Zero frequency at these limits appears reasonable. Zero fecundability is incompatible with pregnancy so that in a fecund group such a fecundability should be lacking. Likewise, a fecundability of 1.0, or certainty of conception during the first month of exposure, is implausible because of such hazards as occasional anovulatory cycles, sickness, and temporary separations.

To complete the model, it is necessary to assume something about contraceptive efficiency and its relationship to fecundability. The simplest assumption is that all couples practice

Fig. 1. A hypothetical distribution of fecundabilities relevant for the urban United States.



contraception with the same efficiency "e"—i.e., all couples reduce their fecundabilities by a factor of "e," thereby reducing their monthly risk of pregnancy to (1-e)p, where "p" signifies their fecundability. Given this assumption about contraceptive efficiency, together with all the other simplifying assumptions, it becomes possible, with the help of calculus, to estimate P, the proportion who become pregnant during the "t" months of the observation period, as well as E, the average length of contraceptive exposure per couple during this observation span. The mathematical details are given in Appendix A. The contraceptive failure rate is then easily derived as (P/E)1200. Since "t," the length of the observation period, and "e," contraceptive efficiency, are being treated as variables in the model, it is possible to compute failure rates for any combination of contraceptive efficiency and observation length.

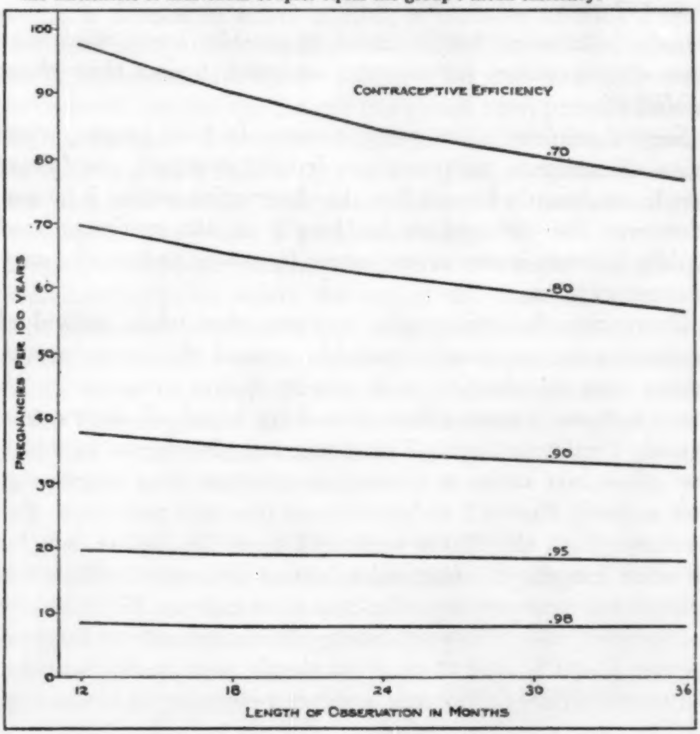
To assume that all couples practice the same efficiency of contraception is not very realistic and it turns out that this assumption minimizes the responsiveness of the failure rate to the length of the observation period. Fortunately, there is an alternative assumption which is also easy to apply and which maximizes the dependence of the failure rate upon length of observation period. This is to posit maximum variability of individual efficiencies around the group mean, instead of no variability at all. For example, maximum variability around a mean efficiency of .9 is given when 90 per cent of the group are treated as practicing perfect contraception (efficiency of 1.0) and 10 per cent are treated as practicing perfectly hopeless contraception (efficiency of zero). More generally, if a mean efficiency of "e" is stipulated, posit a proportion of "e" as practicing perfect contraception and a proportion of 1-e as practicing hopeless contraception. Now the typical degrees to which individual efficiencies of contraception vary around group averages are unknown, but obviously these variations lie between the extremes of no variability and algebraically maximal variability. Accordingly, one hopes that two sets of results based on these extreme assumptions will bracket the correct val-

ues; of course, still contingent upon the other simplifying assumptions.

Results

Results are summarized in Figures 2 and 3. Figure 2 assumes that all couples are practicing the same efficiency of contraception. Figure 3 assumes that individual efficiencies vary maximally around the group mean. In both charts the declines of failure rate with increases in length of observation are graphed for contraceptive efficiencies of .70, .80, .90, .95, and .98. (For each level of contraceptive efficiency, a curve connects failure rates computed for observation lengths of 12, 18, 24, and 36

Fig. 2. Pregnancies per 100 years of contraceptive exposure as related to length of observation period and mean contraceptive efficiency, assuming that the efficiencies of individual couples equal the group's mean efficiency.



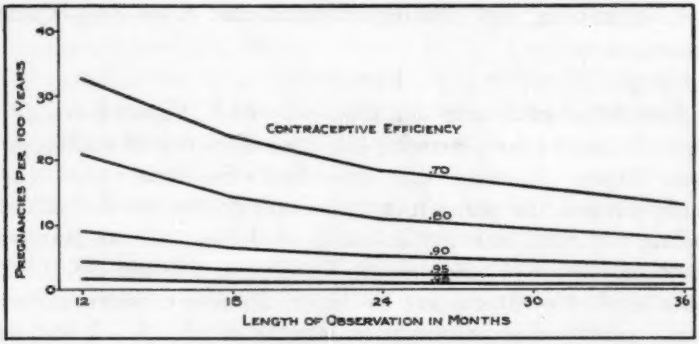


Fig. 3. Pregnancies per 100 years of contraceptive exposure as related to length of observation period and mean contraceptive efficiency, assuming that efficiencies of individual couples are maximally variable around the group's mean efficiency.

months.) It seems hardly useful to consider lower efficiencies since they generate failure rates so much higher than those published.

Several tendencies are worth noting. In both graphs, when mean efficiency of contraception is held constant, the failure rate is consistently lower when the observation period is longer. Moreover the differentials by length of observation period rapidly increase in size as one moves from high to low efficiency of contraception.

Comparing the two graphs, one sees that when individual efficiencies are maximally variable around the group mean, rather than all identical with it, the failure rates are much lower and much more differentiated by length of observation period. Doubtless Figure 3 overestimates the degree to which the failure rate varies as a function of observation length, but just as surely Figure 2 underestimates this responsiveness. Potentially, then, the effects registered upon the failure rate by different lengths of observation period are appreciable even when mean contraceptive efficiency is as high as .95.

Parenthetically it is worth noting, from the contrast between Figures 2 and 3, that there is no simple relationship between the contraceptive failure rate and mean efficiency of contracep-

tion as it is being defined in this paper. Given the same mean efficiency, the contraceptive failure rate will be higher or lower depending on whether individual efficiencies are more or less variable around the group mean.

The results just reviewed are based on a number of simplifying assumptions. One assumption is a successful exclusion of postpartum amenorrhea and anovulation from contraceptive exposures. In practice, when dealing with contraception after a birth, it is conventional to allow one month for postpartum sterility. Even in the contemporary urban United States, where few infants are nursed long durations, periods of postpartum amenorrhea and anovulatory cycles probably average three or four months, perhaps longer.[4] Thus, as contraceptive exposure is defined in many studies, it includes at least 2 or 3 months of postpartum sterility. Obviously the inclusion of such sterility lowers contraceptive failure rates and the bias is proportionately greater the shorter the observation period. Therefore the inclusion of postpartum sterility tends to work against the tendency for a failure rate to be higher when the observation period is shorter. But in each instance the net balance between the two biases is problematical.

Another simplifying assumption is that no couple deliberately stops contraception before the end of the observation period. Such deliberate cessations shorten contraceptive exposures and their effect upon the failure rate is similar to that from shortening the observation period. But quantitative estimates are difficult. The pregnancy postponements intended by couples are so highly variable from one sample to another that a general formulation is virtually impossible.

Some Empirical Examples

The distribution of intended pregnancy postponements is especially important when one is dealing with contraceptive histories that encompass entire interpregnancy intervals or at

[4] See Sharman, A.: Ovulation After Pregnancy. *Fertility and Sterility*, 1951, 2, No. 5, pp. 371–393; Guttmacher, A. D.: Fertility of Man. *Fertility and Sterility*, 1952, 3, No. 4, pp. 281–289; and Tietze, C.: *op. cit.*, pp. 235, 236.

least long portions thereof. In this case, more contraceptive exposures may be deliberately terminated than involuntarily interrupted by pregnancy. Typically too, contraceptive exposures are highly variable and average well in excess of 12 months.

To investigate empirically the effect of observation length in the case of these histories, one may first compute a failure rate using entire pregnancy intervals and then compute a second failure rate using only the first twelve months of these intervals. This latter failure rate simulates the consequence of a 12-month observation period. Thus, if a particular couple experiences an unplanned pregnancy during their 15th month of contraception, their experience is defined as 15 months of contraceptive exposure with one unplanned pregnancy in the former failure rate, based on entire intervals, but as 12 months of contraceptive exposure without a pregnancy in the latter failure rate, which considers only the first 12 months of any interval. These pairs of failure rates have been computed for data from the Indianapolis Study and from the Family Growth in Metropolitan America Study.[5]

All couples of this latter study have two children with few of the parents seeking long postponements of either birth. As a result, contraceptive exposures average a little under 18 months before first pregnancy and barely under 24 months following the first birth. A failure rate of 25.5 pregnancies per 100 years of contraceptive exposure is observed during the initial interval and a rate of 20.4 pregnancies during the interval between first birth and next pregnancy. When

[5] Dr. C. V. Kiser kindly made available the contraceptive records of the Indianapolis couples. A thorough report of these data is contained in Westoff, C. F.; Herrera, L. F.; and Whelpton, P. K.: The Use, Effectiveness, and Acceptability of Methods of Fertility Control, in Whelpton, P. K. and Kiser, C. V. (ed.): Social and Psychological Factors Affecting Fertility, V. 4. New York: Milbank Memorial Fund, 1954, pp. 885–952. A much more specialized analysis of contraceptive materials from the Family Growth In Metropolitan America Study is given in Potter, R. G.: Contraceptive Practice and Birth Intervals Among Two-Child White Couples in Metropolitan America. Thirty Years of Research in Human Fertility. New York: Milbank Memorial Fund, 1959, pp. 74–92. A more comprehensive report of these data will be furnished in Westhoff, Charles F.; Potter, Robert G., Jr.; Sagi, Philip C.; and Mishler, Elliot G.: Family Growth in Metropolitan America. To be published by Princeton University Press.

contraceptive exposures are truncated after the twelfth month, to simulate an observation period of that length, the failure rate of 25.5 jumps to 35.7, while the other failure rate jumps from 20.4 to 27.2. These represent increases of 40 and 35 per cent.

These percentage increases would be less similar except for a balancing of factors. Since contraceptive exposures average longer after first birth than before first pregnancy—24 months instead of 18—one would expect that truncating at 12 months would increase the failure rate more in the later period. But this expectation is not borne out because only one month is allowed for postpartum amenorrhea. As a result, the contraceptive exposures of this later period include appreciable amounts of postpartum sterility and of course such sterility reduces failure rates more when intervals are truncated than when they are left unrestricted.

The initial pregnancy interval of the Indianapolis Study offers an even more spectacular example of what happens when contraceptive histories are truncated at 12 months. The contraceptive histories of this study span marriage durations of 12 to 15 years, with some of the couples practicing contraception this entire time without a pregnancy. Partly because of these couples, contraceptive exposures prior to first pregnancy average 45 months. The failure rate for this first pregnancy interval is 14.4 pregnancies per 100 years of contraceptive exposure.[6] But when exposures are truncated at 12 months, this failure rate almost trebles to 39.7. Clearly a failure rate based on contraceptive histories is not always comparable with a failure rate based on a limited span of observation, such as 12 months.

Conclusion

The contraceptive failure rate, defined as the number of

[6] This rate of 14.4, based on the uninflated sample, differs barely from the rate of 15 published in Westoff, *et al, op. cit.*, p. 928, which was based on the inflated sample. For details of this inflation, see Whelpton, P. K. and Kiser, C. V.: The Sampling Plan, Selection, and the Representativeness of Couples in the Inflated Sample. In Social and Psychological Factors Affecting Fertility, V. 2, New York: Milbank Memorial Fund, 1950, pp. 190–200.

pregnancies per 100 years of contraceptive exposure, is sufficiently inflated by a short observation period so that this factor of observation length deserves high priority as a control in any comparative work. Other things equal, sensitivity to this factor is greatest when contraceptive effectiveness is low, and members of the sample vary greatly in their individual efficiencies. So sensitive is the failure rate to observation length, that it is virtually meaningless to compare a failure rate based on a limited period of observation, such as 12 months, with a failure rate based on entire interpregnancy intervals.

Appendix A. Formulas Used in Deriving Contraceptive Failure Rates for a Hypothetical Population

The density of fecundabilities "p," graphed in Figure 1, is defined by

$$
\begin{aligned}
f(p) &= 100\,p && 0 \leqq p \leqq .02 \\
&= 2.00/.98 - (2.00/.98)p && .02 \leqq p \leqq 1 \\
&= 0 && \text{otherwise.}
\end{aligned}
$$

In the absence of contraception the pregnancy rate per 100 years of exposure during an observation period of "t" months is

$$1200\,P(t)/E(t),$$

where $P(t)$ is the proportion of couples becoming pregnant during the observation period and $E(t)$ is the average number of exposure months per couple. To obtain $P(t)$, we set it equal to $1-\overline{P}(t)$ and solve for $\overline{P}(t)$, the proportion of couples not becoming pregnant during the observation span. Evidently,

$$
\begin{aligned}
\overline{P}(t) &= \int_0^1 (1-p)^t f(p)\,dp \\
&= 100\left\{\left(\frac{1-.98^{t+1}}{t+1}\right)-\left(\frac{1-.98^{t+2}}{t+2}\right)\right\} \\
&\qquad + \frac{2.00}{.98}\left(\frac{.98^{t+2}}{t+2}\right)
\end{aligned}
$$

Regarding E(t), the average number of exposure months among couples sharing a fecundability of "p" is

$$
\begin{aligned}
& p + 2\cdot qp + 3\cdot q^2p + \ldots + tq^{t-1}p + tq^t \\
&= p(1 + 2q + 3q^2 + \ldots + tq^{t-1}) + tq^t \\
&= p\left\{\frac{1 + q + q^2 + \ldots + q^{t-1} - tq^t}{1-q}\right\} + tq^t \\
&= 1 + q + q^2 + \ldots + q^{t-1} \\
&= (1-q^t)/(1-q) \\
&= \frac{1-(1-p)^t}{p}.
\end{aligned}
$$

Taking the full range of fecundabilities, we have then

$$
\begin{aligned}
E(t) &= \int_0^1 \left(\frac{1-(1-p)^t}{p}\right) f(p)\,dp \\
&= 2 - \frac{100}{t+1}(1 - .98^{t+1}) + \frac{2.00}{.98}\left(\frac{.98^2}{2} + \frac{.98^3}{3} + \ldots + \frac{.98^{t+1}}{t+1}\right)
\end{aligned}
$$

When contraception of "e" efficiency is practiced, fecundabilities of "p" are replaced by monthly risks of contraceptive failure of

$$p' = (1-e)p.$$

The density of "p′" is defined by

$$
\begin{aligned}
g(p') &= 100\,p'/(1-e)^2 && 0 \le p' \le .02(1-e) \\
&= \frac{2.00}{.98}\left(\frac{1}{1-e}\right) - \frac{2.00}{.98}\left(\frac{1}{1-e}\right)^2 p' && .02(1-e) \le p' \le (1-e) \\
&= 0 && \text{otherwise.}
\end{aligned}
$$

In accord with its definition as the number of pregnancies per 100 years of contraceptive exposure, the contraceptive failure rate is given by

$$1200\,P'(t)/E'(t).$$

Here $P'(t) = 1 - \bar{P}(t)$, with

$$\bar{P}'(t) = \int_0^{(1-e)} (1-p')^t g(p')dp'$$

$$= \frac{100}{(1-e)^2}\left\{\left(\frac{1-v^{t+1}}{t+1}\right) - \left(\frac{1-v^{t+2}}{t+2}\right)\right\}$$

$$+ \frac{2.00}{.98}\left(\frac{1}{1-e}\right)\left(\frac{v^{t+1}-e^{t+1}}{t+1}\right)$$

$$- \frac{2.00}{.98}\left(\frac{1}{1-e}\right)^2 \left\{\left(\frac{v^{t+1}-e^{t+1}}{t+1}\right) - \left(\frac{v^{t+2}-e^{t+2}}{t+2}\right)\right\}$$

when $v = .98 + .02e.$

$$E'(t) = \int_0^{1-e} \left(\frac{1-(1-p')^t}{p'}\right) g(p')dp'$$

$$= \frac{100}{(1-e)^2}\left\{(1-v) - \left(\frac{1-v^{t+1}}{t+1}\right)\right\}$$

$$- \left(\frac{2.00}{.98}\right)\left(\frac{1}{1-e}\right)^2 \left\{(v-e) - \left(\frac{v^{t+1}-e^{t+1}}{t+1}\right)\right\}$$

$$+ \left(\frac{2.00}{.98}\right)\left(\frac{1}{1-e}\right)\left\{(v-e) + \left(\frac{v^2-e^2}{2}\right) + \cdots + \left(\frac{v^t-e^t}{t}\right)\right\}$$

The above formulas are useful only when it is assumed that all couples are practicing contraception with the same efficiency "e." Alternatively one might assume that a proportion "m" of the couples are practicing perfect contraception while a proportion $1 - m$ are practicing contraception of zero efficiency. For the former group, $P'(t) = 0$ and $E'(t) = t$; for the latter, $P'(t) = P(t)$ and $E'(t) = E(t)$. Combined, the two subgroups have a contraceptive failure rate of

$$\frac{1200(1-m)P(t)}{mt + (1-m)E(t)}.$$

EFFECT OF INDUCED ABORTION ON THE REDUCTION OF BIRTHS IN JAPAN[1]

MINORU MURAMATSU, M.D., DR.P.H.

HISTORICAL FOREWORD

PROBLEMS arising from the pressure of human numbers on the limited amount of natural resources available are not a new phenomenon suddenly appearing after the last war in Japan. Even as early as in 1930, the national leaders were seriously concerned about the problems. When the possibility of improving the level of living was threatened by a rising population even to a slight degree, it became a matter of concern among the Japanese people.

The growth of the population of Japan became phenomenal soon after the last War as a result of the combination of the unusually high natural increase rate together with the increase from repatriation and demobilization. There was wide public awareness that the economy of Japan would have great difficulty in making the necessary postwar recovery and in expanding rapidly enough to support the increasing population.

Thus, an intense desire to limit family size became widespread. The predominant means frequently used by the average married couple for the regulation of fertility was induced abortion. It is to be noted, however, that what has drawn the attention of those interested in human fertility throughout the world to Japan is not the simple fact of stated wishes for smaller families. This exists to varying degree in many countries. The extraordinary fact is that the Japanese people used the means available to them and actually had the smaller families that were their stated goals. The rapid fall in the birth rate since the end of the War can be easily noted in Table 1. In 1947 the number of births per 1,000 population was 34.3; in 1957, it was

[1] The present work was conducted by the author while he was with the Maternal and Child Health Division, Department of Public Health Administration, School of Hygiene and Public Health, The Johns Hopkins University. Acknowledgments are particularly due Drs. Paul A. Harper and Rowland V. Rider for suggestions and assistance. Discussions and interpretations of the findings presented in the present article are entirely the author's own responsibility.

17.2. This was a reduction of 50 per cent within a decade. It is recognized that the 1947 rate was unduly high. Nonetheless, the decline was phenomenal.

Table 1. Rates of birth, death, and natural increase per 1,000 population, Japan, 1920–1957.

Year	Birth Rate	Death Rate	Natural Increase Rate
1920	36.2	25.4	10.8
1925	34.9	20.3	14.7
1930	32.4	18.2	14.2
1935	31.6	16.8	14.9
1940	29.4	16.5	12.9
1947	34.3	14.6	19.7
1949	33.0	11.6	21.4
1951	25.3	9.9	15.4
1953	21.5	8.9	12.6
1955	19.4	7.8	11.6
1957	17.2	8.3	8.9

Source: Annual Reports of Vital Statistics, Ministry of Welfare, The Japanese Government. A summary presentation can be found in the statistical journal, *Kosei No Shihyo—Annual Summary for* 1957, published by the Statistical Division of the Ministry of Welfare.

Admittedly there are several factors responsible for the rapid spread of family planning throughout Japan in the postwar years. The official sanction for birth limitation expressed by the Government in 1948 may be one example. It is to be emphasized, however, that the really significant factor in the intensified efforts of the Japanese to adjust the numbers of their offspring to the environment in which they found themselves was the strength of the motivations in the general public.

The focus of current discussions in Japan is on the problem of means to achieve the ends of family limitation rather than the ends themselves. How can we shift from induced abortion to the prevention of conception? This arouses vigorous discussion, particularly among those concerned with the medical aspect of the situation. There is an expectation of progress toward the goal of altered means in the future, though it is recognized that progress may be rather slow.

Introduction

After the enactment of the Eugenic Protection Law in 1948 in Japan, which deals with the regulations concerning the performance of induced abortion and sterilization operations, there was a precipitous increase in the number of induced abor-

tions performed legally and reported officially to the health authorities. (Table 2.) Although the upward trend of induced abortion seems to have reached a maximum point in recent years, the role it plays in the reduction of births is believed to be significantly great.

There have been to date a small number of studies conducted in Japan with regard to the extent to which induced abortions were responsible for the reduction of births in recent years. All were based upon a direct estimation of all the induced abortions, including those not officially reported, developing from there an estimate of the number of live births prevented by induced abortion.

The present study has a similar aim. The procedures followed, however, are somewhat different and are designed to arrive at this estimate on the basis of research data obtained so far in Japan as well as in other countries, without depending upon the direct estimation of total number of induced abortions performed.

The present article is intended to show the extent to which induced abortions have reduced births in recent years in Japan, taking 1955 as the year of observation. Whether or not induced abortion is a *good* way of limiting the size of family is entirely a different matter. It involves many considerations, such as moral, medical, psychological, and social factors bearing upon

Table 2. Reported induced abortions and registered live births, Japan, 1949–1957.

Year	Induced Abortions	Live Births	Abortions per 100 Live Births
1949	246,104	2,696,638	9.1
1950	489,111	2,337,507	20.9
1951	638,350	2,137,689	29.9
1952	798,193	2,005,162	39.8
1953	1,068,066	1,868,040	57.2
1954	1,143,059	1,769,580	64.6
1955	1,170,143	1,730,692	67.6
1956	1,159,288	1,665,278	69.6
1957	1,122,316	1,566,713	71.6

Source: Statistics concerning the Eugenic Protection Law, published by the Ministry of Welfare, and Annual Reports of Vital Statistics, Ministry of Welfare, The Japanese Government.

the performance of induced abortion for the purpose of family limitation.

General Principles of Procedures

1. Using available data on the prevalence of contraceptive practice in Japan, its effectiveness and also the prevalence of sterilization operations performed among Japanese women, estimate the number of married women who did not participate in reproductive activities because of contraceptive practice or sterilization in 1955.

2. To the remaining group of married women who could participate in reproductive activities in 1955, apply theoretically derived estimates of the live birth rates to be expected in

Table 3. Estimated number of married women with successful practice of contraception, by age, Japan, 1955.

Age	Number of Married Women, in Thousands[a] (1)	Per Cent of Married Women with Contraceptive Practice[b] (2)	Per Cent Effectiveness of Contraceptive Practice[c] (3)	Estimated Number of Married Women with Successful Contraception, in Thousands (1) × (2) × (3)
15–19	74	20.7	50	8
20–24	1,374	31.7	50	218
25–29	2,930	38.7	50	568
30–34	2,831	41.1	50	583
35–39	2,349	38.1	50	449
40–44	2,107	24.5	50	259
45–49	1,736	10.2	50	89

Notes: [a] National Census, 1955.

[b] Data obtained in the Conception Control Survey by the Ministry of Welfare, The Japanese Government, 1954. A random sampling method was employed in this Survey, the sampling ratio being 1/100, and the findings were based upon the replies from 93,938 couples in which the wife was under 50 years old. (Muramatsu, Minoru: Some Facts about Family Planning in Japan. Tokyo: The Mainichi Newspapers, 1955, pp. 87, ff.)

[c] Based on the data obtained in a survey of induced abortion by the Institute of Public Health, Tokyo, 1952. In this survey personal interviews were conducted with women who had had at least one induced abortion, and some detailed questioning was made as to their health and demographic experiences before and after the abortion. The effectiveness ratio was obtained by the comparison of two pregnancy rates, one without contraceptive practice and the other with such practice observed among some 600 women. (Muramatsu, Minoru, *et al.:* A Survey of Health and Demographic Aspects of Induced Abortion in Japan—Special Report No. 5. *Bulletin of the Institute of Public Health*, Tokyo, April, 1956, 5, No. 3.)

The Institute of Population Problems in Tokyo also reported their finding in this respect as about 50 per cent. (*The World of Obstetrics and Gynecology*, 1955, 7, No. 2, p. 89.)

Matthew Tayback *et al.* found approximately the same level of effectiveness of contraception in a recently conducted survey in Puerto Rico. (Tayback, Matthew, *et al.:* Birth Control in a Rural Area of Puerto Rico. *Eugenics Quarterly*, 1958, 5, No. 3, pp. 154–161.)

the absence of fertility control practices. The results would indicate the expected number of legitimate live births in 1955 if there were no induced abortion.

3. To the expected number of legitimate live births, apply the ratio of illegitimate live births to legitimate live births that was actually observed in 1920 in Japan. The results would be an estimate of the number of illegitimate live births to be expected in 1955 if there were no induced abortion.

4. Sum up the expected numbers of legitimate and illegitimate live births in order to obtain the expected total live births in 1955.

5. The difference between the expected total live births and the actually registered live births in 1955 can be regarded as the effect of induced abortion on the reduction of births. If we know the number of induced abortions required to prevent the number of births estimated this way, then we may, by comparing the number of actually reported induced abortions with the number of abortions required, find the level of completeness in the reporting of induced abortions in 1955.

Computations

1. Table 3 shows the procedures by which the numbers of married women with successful practice of contraception in 1955 can be estimated.

2. Table 4 shows the estimation of the numbers of married women who had had a sterilization operation performed in 1955.

3. If we subtract the numbers of married women by 5-year age group who did not participate in reproductive activities because of contraception or sterilization as estimated above from the total numbers of married women in 1955, the results would indicate the estimated numbers of married women who could participate in reproductive activities in that year.

4. The next step is to find estimates of the age-specific live birth rates to be expected in the absence of fertility control practices and to apply them to those married women who could

participate in reproductive activities in 1955 as estimated above.

This estimation involves two factors. One is the proportions of women who are capable of bearing living offspring among all the married at various ages. The other is the frequency of live births per fecund woman per year when there is no effort to control childbearing.

It is generally regarded as reasonable among demographers to assume that the frequency of live births per fecund woman per year remains almost constant at all ages.[2] Therefore, if we could find some reasonable estimates of these two factors, then an estimate of the age-specific live birth rate per married woman per year among those practicing no fertility control could be obtained for any given age by combining the two factors.

In regard to the proportions of women who are capable of bearing living offspring at successive ages, Frank Lorimer has developed a hypothetical model which seems to serve the purpose of the present estimation.[3] Briefly, this model was con-

Table 4. Estimated number of married women who had had a sterilization operation performed, by age, Japan, 1955.

Age	Number of Married Women, in Thousands (1)	Per Cent of Married Women Sterilized[a] (2)	Estimated Number of Married Women Sterilized, in Thousands (1) × (2)
15–19	74	0.2	0
20–24	1,374	0.4	5
25–29	2,930	1.4	41
30–34	2,831	3.1	88
35–39	2,349	4.4	103
40–44	2,107	4.6	97
45–49	1,736	4.7	82

Note: [a] Based on the data obtained in a survey conducted by the Population Problems Research Council, The Mainichi Newspapers, Tokyo, in 1955. This survey aimed to cover some 3,800 couples as a representative sample of couples in which the age of the wife was under 50 years, its sampling ratio being 1/3,700. The figures used in the present study are a modification of the original data published by the investigators, since they did not provide information as to the frequency of female sterilization by each 5-year age group but only by a broader age grouping. (Third Public Opinion Survey on Birth Control in Japan. The Population Problems Research Council, The Mainichi Newspapers, Tokyo, 1955.)

[2] Lorimer, Frank, *et al.*: Culture and Human Fertility. unesco, 1954, p. 51.

[3] *Ibid.*, pp. 52–53.

structed by combining three elements involved in the procreative capacity of human females. They are (1) the variation in the maturation of procreative capacity with age, (2) the degree of losing the capacity due to the accumulation of impairments to fecundity with advance in age, and (3) the influence of aging upon fecundity in association with the menopause. Thus, the proportion of women capable of procreation of living offspring can be computed for any given age by taking into consideration these three elements altogether. (The influence of concomitant variations in the procreative capacity of males is assumed to be taken into consideration in the formulation of this model.)

As for the frequency of live births per fecund woman per year, Lorimer gives an arbitrary figure of 0.36 births in his hypothetical model of fecundity.[4] This figure, if combined with the proportions of women capable of procreation mentioned above, would give a total of 8.3 live births per woman for a period from 14 to 53 years of age, if she was fully exposed to the risk of conception continuously.

According to Christopher Tietze, the highest level of human fertility ever observed is found in the data obtained from the 1941 census of Canada. Among those married women in rural areas of Catholic Quebec who had experienced no or little effort of birth limitation, the average total number of live births per woman for a period from 18 to 45 years of age was found to be 10.6.[5] If the proportions of women capable of procreation as estimated in the hypothetical model described above were applied, the 10.6 total births for a period of 27 years of marriage before menopause would represent 0.49 live births per fecund woman per year.

In one of the reports of the findings obtained in the Indianapolis fertility study which covered some 1,100 couples, the reproductive capacity of the "relatively fecund" couples was

[4] *Ibid.*, p. 51.

[5] Tietze, Christopher: The Clinical Effectiveness of Contraception. THIRD INTERNATIONAL CONFERENCE ON PLANNED PARENTHOOD, REPORT OF THE PROCEEDINGS. Bombay, India, 1952.

estimated at 0.45 births per year during the first 13 years of married life, if there was no effort to control fertility at all.[6]

When the present writer conducted a field survey of induced abortion in Japan in 1952, one of the analyses revealed that the pregnancy rate (i.e., the number of pregnancies which occurred per 100 woman-years of exposure to the risk of pregnancy) was about 75 for the period during which no voluntary limitation of fertility was exercised among those women who had had at least one induced abortion prior to the personal interview. This finding is based on the reproductive histories given by some 600 women the majority of whom belonged to the age group 35 to 39 years and whose capacity of reproduction was demonstrated by the fact that they all became pregnant and had an induced abortion shortly before the interview.[7] If this preg-

Table 5. Expected number of legitimate births in the absence of induced abortion, by five-year age group, Japan, 1955. (On the three possible assumptions of fecundity level.)

Age	Estimated Number of Married Women Who Could Participate in Reproductive Activities, in Thousands[a] (1)	Women Capable of Procreation, Per Cent of All Women[b]	Expected Live Birth Rate, per 100 Women[c] (2)			Expected Number of Live Births, in Thousands (1) × (2)		
			High Est.	Medium Est.	Low Est.	High Est.	Medium Est.	Low Est.
15–19	66	33.9	15.3	13.9	12.5	10	9	8
20–24	1,151	93.0	41.9	38.1	34.4	482	439	396
25–29	2,321	90.0	40.5	36.9	33.3	940	856	773
30–34	2,160	84.8	38.2	34.8	31.4	825	752	678
35–39	1,797	77.0	34.7	31.6	28.5	624	568	512
40–44	1,751	62.5	28.1	25.6	23.1	492	448	404
45–49	1,565	14.6	6.6	6.0	5.4	103	94	85
(Total Live Births per Woman, 15–49 Years)			(10.3)	(9.3)	(8.4)	3,476	3,166	2,856

Notes: [a] (Number of married women)—(Estimated number of married women with successful practice of contraception, Table 3)— (Estimated number of married women sterilized, Table 4).
[b] Lorimer, Frank, *et al.*, Culture and Human Fertility, unesco, 1954, pp. 52–53.
[c] (Number of live births per fecund woman per year) × (Proportion of women capable of procreation) × 100. The number of live births per fecund woman per year was assumed to be 0.45, 0.41, or 0.37 respectively for the high, medium, or low estimate.

[6] Lorimer, F., *et al.: op. cit.*, p. 40.
[7] Muramatsu, Minoru, *et al.:* A Survey of Health and Demographic Aspects of Induced Abortion in Japan—Special Report No. 5. *Bulletin of the Institute of Public Health,* Tokyo, April, 1956, 5, No. 3.

nancy rate of 75 was converted into the number of live births per woman per year, it would represent 0.41 births.

In view of these somewhat different values observed for the number of live births per woman per year in a fecund conjugal union, three different levels of fecundity may be tried in the present study in order to obtain the high, medium, and low estimates of the number of live births to be expected among those Japanese married women who could participate in the reproductive activities in 1955 if there were no induced abortion at all. Thus, it may be suggested to use the three figures of 0.45, 0.41, and 0.37 live births. (0.45 and 0.37 are 10 per cent above and below 0.41 respectively.) Once these figures are set, it is possible to determine the expected rate of live births at any age by the use of proportions of women capable of procreation as discussed above.

Table 5 shows the procedures through which the three possible estimations have been made in regard to the number of live births to be expected among the married women in 1955. The average age of each 5-year age group was assumed to be its mid point. It is noted that some 3.5 to 2.9 million legitimate births would have occurred in 1955 if there were no induced abortion at all.

5. The estimation of illegitimate births to be expected in 1955 in the absence of induced abortion presents considerable difficulties. It appears that the only possible approach we may use with certain reasonableness is to review the trend of illegitimate births that occurred in the past in Japan.

The first year for which the officially published data are available in this regard is 1920. In 1920, 8.2 per cent of all live births were illegitimate. The proportion then decreased to 6.4 in 1930, 4.1 in 1940, 2.5 in 1950, and less than 2 per cent in 1955. It is reported that fertility control practices have been particularly significant in the elimination of illegitimate births in recent years.

In such early years as 1920, we may assume that induced abortions used to prevent illegitimate births were not so preva-

lent. However, it is estimated that some of the illegitimate births did not appear as such in the official data in those years as the women who were desperate may have resorted to infanticide or other means to avoid registering illegitimate births. Also, it is probable that some primitive contraceptive methods were used to some extent even in those early years to prevent the conception of illegitimate births.

With these reservations in mind, the earliest reliable statistic available in regard to the frequency of illegitimate births in Japan is used in the present estimation, namely, the 8.2 per cent among all births. Thus, the objective here is to see how many illegitimate births we would expect if the 1920 figure is applied to 1955. It is admitted that this may yield a rather conservative estimation of the number of illegitimate births prevented by induced abortion in 1955.

The assumption of 8.2 per cent illegitimate births among all births corresponds to a ratio of 8.9 illegitimate births to 100 legitimate births. Therefore, the expected number of illegitimate births in the absence of induced abortion in 1955 would be 309, 282, or 254 thousand respectively for the high, medium, or low estimation discussed in the preceding paragraph.

6. Thus, the number of all live births to be expected in 1955 if there were no induced abortion at all, would be 3,785, 3,448, or 3,110 thousand respectively for the high, medium, or low estimation.

7. The number of live births actually registered in 1955 was 1,731 thousand. Thus, it is estimated that 2,054, 1,717, or 1,379 thousand births would have been prevented by the induced abortions performed in 1955.[8]

8. In a recent survey conducted by the present writer and his colleagues in Tokyo which covered some 2,400 women who visited the out-patient department of a Red Cross maternity

[8] More precisely, induced abortions which served to prevent live births from actually occurring in 1955 are those which were performed from July, 1954, through June, 1955, if the average month of pregnancy when an induced abortion is performed is assumed to be the end of the third month. In the present computation, however, this point was not taken into consideration as the difference between 1954 and 1955 in regard to the number of reported induced abortions was rather small.

hospital in 1954, 1955 and 1956, it was found that among women having at least one induced abortion in a given calendar year, the average number of such abortions was actually 1.1.

It follows, then, that in order to prevent the 2,054, 1,717, or 1,379 thousand births, there would have been required 2,259, 1,889, or 1,517 thousand induced abortions performed in 1955, according to the high, medium, or low estimation respectively. The number actually reported was 1,170 thousand induced abortions. Consequently, the completeness of reporting of induced abortions in 1955 may be estimated at 51.8, 61.9, or 77.1 per cent respectively.

Discussion

The three estimates were developed by placing an arbitrary 10 per cent range around 0.41, the value from the author's work selected as the probable number of live births per fecund woman per year. Ranges could have been applied in similar fashion to the several other indices on which the final estimates were based. It must be emphasized, therefore, that the range of the estimates is possibly too small. However, it was decided not to attempt an elaborate use of ranges for each intermediate index or ratio. The following considerations deal with the question as to which one of the three estimates may be closer to the actual situation which prevailed in Japan in 1955.

There is evidence which suggests that we may have underestimated the expected number of births, and, hence, the number of induced abortions. (1) The application of 1920 ratio of illegitimacy to 1955 as discussed before. (2) The assumption made in this study about the average age of married women in each 5-year age group. As noted in Computation Step 4 above, the average age of each 5-year age group was assumed to be its mid point. This certainly would have resulted in an underestimation of the proportion of women capable of procreation particularly in the youngest age group, 15–19 years, since the age of the majority of married women in this group was undoubtedly close to the end point of this interval.

Also, it is noted that the fecundity levels used in the high and medium estimates were more or less similar to those actually observed in recent years, whereas the figure used in the low estimate was lower than any of the observed values.

If all of these considerations were put together, one is inclined to think that the high or medium estimate would probably be more valid. On the other hand, one possible factor which makes the results overestimated is that it is apparently unrealistic to expect that all the married women were fully exposed to the risk of conception *continuously* during the year under observation. However, this factor does not seem very serious in the present considerations, since the computations were based on those women who reported themselves as being married at the time of census enumeration in October, 1955, and also the period of observation is only one year.

In view of these various conditions, the writer is under the impression that the medium or high estimation probably reflects more faithfully the actual situation which prevailed in 1955 in Japan.

Conclusions and Summary

An attempt was made to estimate the number of births that would have occurred in 1955 in Japan if there were no induced abortion.

From the total number of married women in 1955, those who did not participate in reproductive activities because of contraception or sterilization were subtracted. The estimates of the number of married women practicing contraception successfully and of those sterilized were made by the use of data obtained from sample studies conducted in Japan. Then, to those who could participate in reproduction, theoretically derived estimates of the age-specific birth rates to be expected in the absence of fertility control practices were applied. This estimate of birth rates was made by combining two factors involved in human fertility.

One is the proportions of women who are capable of bearing

living offspring at various ages. A hypothetical model developed by Frank Lorimer was used for this factor. The other is the expected number of live births per fecund woman per year when she is fully exposed to the risk of conception, which is assumed to remain almost constant during her childbearing ages. In view of the somewhat different levels of fecundity observed in the past in various parts of the world, three different assumptions were made in the present study in this regard in order to obtain high, medium, and low estimates, namely, 0.45, 0.41, and 0.37 live births per woman per year respectively.

According to these three estimates, the expected number of legitimate births in 1955 was about 3.5, 3.2, or 2.9 million respectively.

To these numbers of estimated legitimate births, the ratio of illegitimate births to legitimate births observed in 1920 in Japan was applied in order to estimate the number of illegitimate births to be expected in 1955 if there were no induced abortion. Presumably this procedure would yield a somewhat conservative result, since it is believed that in 1920 some fertility control practices were used to avoid illegitimacy. In any event, the estimates of illegitimate births derived this way are approximately 310, 280, and 250 thousand respectively for the high, medium, and low assumptions.

Thus, it was estimated that about 3.8, 3.4, or 3.1 million live births would have occurred in 1955, including both legitimate and illegitimate, if there were no induced abortions at all.

The actually registered number of live births in 1955 was 1.73 million. Therefore, it was estimated that about 2.1, 1.7, or 1.4 million births were prevented by the induced abortions performed in 1955. On the other hand, in a survey conducted in Japan recently it was found that among women having at least one induced abortion in a given calendar year, the average number of such abortions was actually 1.1. It follows, then, that in order to prevent the number of births estimated above, some 2.3, 1.9, or 1.5 million induced abortions would have been required as compared with the actually reported 1.17 million.

The completeness of reporting of induced abortions could therefore be estimated at about 52, 62, and 77 per cent respectively for the high, medium, and low assumptions.

Among these three different estimates, the writer is under the impression that probably the medium or high estimate of induced abortions reflects more faithfully the actual situation of 1955 in Japan. The low estimate may be somewhat too conservative, if we take into account the several conditions involved in the procedures which tended to underestimate the expected number of births in 1955.

In summary, it can be stated that the number of live births in 1955 in Japan would have amounted to twice (or more) the number actually registered, if there had been no induced abortion at all. And, the reporting of induced abortions to the health authorities probably included only 50 to 60 per cent of all cases actually performed.

THE PREVENTION OF UNWANTED PREGNANCIES IN A JAPANESE VILLAGE BY CONTRACEPTIVE FOAM TABLETS

Yoshio Koya, Dr. Med. Sci.[1] and Tomohiko Koya, Dr. Med. Sci[2]

Vaginal foam tablets which produce carbon dioxide when moistened by semen or vaginal fluid have many qualities desirable in a contraceptive method. They are inexpensive, easy to use, and easy to learn to use. One user can instruct another without the cost involved in an examination by an especially trained person. No advance preparation is necessary, and there is nothing to remove or wash or dry. The small tube in which the tablets are packed (1.5 cm. in diameter and 8 cm. long) is readily concealed from curious observers.

Because of the advantages of the method and its appropriateness for a public health program to control family size, it seemed worthwhile to make a quantitative test to determine the pregnancy rate among users of foam tablets. This report summarizes the findings of a four year period of observation.

The Population Studied

The test was made in Kajiya Mura, a village with a population of about 1,500 near the seacoast, 40 miles south of Tokyo.

We chose this village as we were informed that many people there could not afford to buy contraceptives even though they wanted to practice birth control. It was thought that they would use foam tablets if they were provided free of charge.

After due arrangements were made we visited this village in December, 1954, assembled as many wives as possible in a hall and gave them talks on the importance of family planning as we formerly did in other places. The number of women attending was fairly large at the beginning. It decreased after the

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second visit when we announced that we could not provide any contraceptive except foam tablets free of charge.

At the end of the first experimental year (1955) there were 39 wives who had used foam tablets for at least one month. This number increased to 64 in the second year. It was 56 in the third year and 57 last year (1958). The total number of wives who had used foam tablets for at least one month during the four year period of study was 82.

Procedure

Chosen for the study was a contraceptive foam tablet, Sampoon, made in Japan, which had previously been found to reduce the pregnancy rate (1). It weighed 0.55 grams and was made from the formula:

	Per Cent
Phenylmercuric Acetate	0.2
Potassium Bitartrate	53.0
Sodium Bicarbonate	20.0
Calcium Carbonate	1.0
Boric Acid	1.0
Starch	20.3
Talcum	3.5
Eggwhite	1.0

To protect the tablets from moisture before use, they were packed in small glass vials, each holding 16. The stopper was of rubber, 5 mm. thick. Instructions for the use of the tablets were simple. The wife was told to keep the stopper in the bottle except during the brief opening necessary for the removal of a tablet. She was told to place the tablet with her finger as far into the vagina as possible, just before intercourse. No subsequent procedure, such as douching, was prescribed.

The tablets were offered as mentioned above without charge to families in which the wife had not reached the menopause. The offering began January 1, 1955, and each family that used foam tablets was followed until December 31, 1958.

Effects of the Program

We recorded the numbers of pregnancies, births, induced abortions, miscarriages, etc., only for the tablet users, as this study was planned just to learn the effectiveness of the foam tablet, and not to learn the acceptance by the community for any contraceptive. We also recorded similar data for tablet users in previous years because it was desired to compare the results before and after using the foam tablets.

As seen in Table 1, the number of couples using foam tablets for more than one month varied by year. The pregnancy rates of the users declined from 15.3 (per 100 years of exposure with this method) in 1955, to 9.5 in 1958. For the 82 women who used foam tablets for one month at any time during 1955-1958, the pregnancy rate was 11.9 per 100 years of exposure to the risk of pregnancy. Accordingly, the average number of months of use for a wife was 22.1, with its standard deviation 1.6.

It is interesting to study the reproductive performance of

Table 1. Pregnancy rates and termination of pregnancies among users of contraceptive foam tablets in a Japanese village. Data relate to periods of use during 1955–1957 and to five years preceding use (1950–1954).

Year	Experience During Use of Foam Tablets						
	Number Wives Using Foam Tablets More Than One Month	Number Months Exposed to Pregnancy	Number Pregnancies	Terminations of Pregnancies			Pregnancy Rate Per 100 Years of Exposure (Stix-Notestein)
				Births	Induced Abortions	Others	
1955	39	313	4	0	4	0	15.3
1956	64	516	6	1	5	0	13.9
1957	56	476	4	1	3	0	10.0
1958	57	504	4	0	3	1	9.5
1955–1958	82	1,809	18	2	15	1	11.9
	Experience Five Years Preceding Use						
1950–1954	82	2,908	128	101	19	8	52.8

the 82 women before they began using the foam tablets. The table shows that they had 128 pregnancies during five years preceding the study (1950–1954), corresponding to a pregnancy rate of 52.8. This rate suggests that the majority of these couples did not use any contraceptives in the earlier period during which only 19 of 128 pregnancies had been terminated by induced abortion, compared with 15 among 18 during 1955–1958. The pregnancy rate of 11.9, brought about by the use of foam tablets in the succeeding four years is somewhat lower than the rate for condom, 13.1, shown in our studies of six experimental areas in Japan (three villages and three settlements of coal miners) where 46 pregnancies had occurred during 5,143 couple-months of exposure (2).

Summary

Eighty-two couples in a Japanese village used contraceptive foam tablets for at least one month during the observation from 1955 to 1958. The pregnancy rate during periods of use was 11.9 per 100 years of exposure, while the corresponding rate in 1950–1954 when no contraceptive was used, was 52.8. The rate while using foam tablets is somewhat lower than the rate for condom obtained from our previous studies.

Considering these findings we reached a conclusion that the foam tablet (Sampoon) is effective enough to be recommended to the people at large. Its potential value increases when the ease of use is considered.

Acknowledgment

Thanks are due to the National Committee on Maternal Health, New York, for a contribution of part of the cost of the study.

References

1. Gamble, C. J.: Pregnancy Rates During the Use of Contraception in India and Pakistan. Report of Proceedings of the 5th International Conference on Planned Parenthood, October, 1955. International Planned Parenthood Federation, London, 1956, p. 145.

2. Koya, Y.: Seven Years of a Family Planning Program in Three Typical Japanese Villages. The Milbank Memorial Fund *Quarterly*, October, 1958, xxxvi, No. 4, pp. 363–372.

ANNOTATIONS

MENTAL ILLNESS IN LONDON[1]

This publication represents a substantial contribution of mental hospital statistics, a useful commentary on some of the methodological problems, and a monument to a colleague who in her short period of interest in mental hospital data produced this useful study which will have to be kept on the same reference shelf as the studies by Malzberg, Dayton, Odegaard, Kramer, and their like.

London has psychiatric "observation units" which apparently serve functions similar to many American psychopathic units. The City is also served by a number of government mental hospitals whose functions are in many ways analogous to American state hospitals. Dr. Norris has made a statistical study based on all admissions to two of the observation units and three mental hospitals during 1947, 1948, and 1949.

	Beds
Observation Unit A	82
Observation Unit B	76
	158
Three Mental Hospitals About	7,000

	Admissions	
	Men	*Women*
Observation Unit A	1,502	1,851
Observation Unit B	2,878	2,770
	4,380	4,621

[1] Norris, Vera: Mental Illness in London. Maudsley Monographs No. 6. London, Institute of Psychiatry, 1959, 320 pp. 35s.

Of These, Transferred to Mental Hospitals Surveyed	2,831	3,482
plus Direct (= "straight") Admissions to Mental Hospitals Surveyed	588	797

Data are provided for each of these groups of patients. The data sheets on which information was recorded are reproduced at the end of the book and the coding instructions on the immediately preceding pages. The data were obtained from the hospital records. Part of the data have to do with "follow-up" until 31 December 1951 to determine which of the following categories described the patient's subsequent experience with these hospitals:

A. Died in observation unit.
B. Transferred to mental hospitals.
   i. Died there.
   ii. Remained there until 31 December, 1951.
   iii. Transferred to other mental or general hospital, or other special hospital.
   iv. Was discharged and was readmitted prior to 31 December, 1951.
   v. Was discharged and not readmitted prior to 31 December, 1951.
   vi. Discharged to non-medical institutions or own home.

Some attempt was made to get this information through visits to thirteen mental hospitals to which patients had been transferred. Information was also obtained from the Board of Control. While these steps undoubtedly increased the number of patients with completed information, it is very hard for the reader to judge from the description on pp. 17 and 18 which categories of patients were most affected by these steps. The function of possible bias in the results is considerable since when patients who were discharged home from mental hospitals were not found to have been readmitted, they were assumed to have survived without subsequent psychiatric contact. Hence all readmission rates reported are underestimates to an unknown extent.

The information recorded on the data sheet included the

usual identifying characteristics, records of prior mental hospital admissions, diagnosis, legal status, disposal, duration of stay, number of subsequent admissions (and their durations), state of patient at end of follow-up.

A medical statistician can obviously make a series of tables from such a body of data which would throw light on many questions important to those interested in the operation of mental hospitals, to those specially concerned with the field of psychiatric statistics and to persons concerned with understanding the nature and extent of mental health problems. These data might also be used to illustrate and illuminate some characteristics of a government medical service and certain features of institutional sociology. Dr. Norris was interested in the first group of questions, but paid little attention to the second. She has provided a rich body of information which is reported in sufficient detail for the reader to get a complete picture of how she arrived at her tables, if he is willing to follow her descriptions carefully. Because of the complex nature of her sample it is necessary at times to search for exact descriptions of her sources of data for a particular table. Tables and graphs are not adequately labeled for this purpose and it is necessary to read widely in the text to get a picture of their contents at times. The absence of an index or list of tables makes this time-consuming but it is generally worth the effort.

First Admission Rates. The three mental hospitals were assigned catchment areas in 1948 when the National Health Act went into effect. Dr. Norris assumes that, in effect, they served the same catchment areas during 1947 and computes age-specific first-admission rates based on this assumption. These are rates to "mental hospitals" and do not take account of admissions to "observation units." ("Observation units" do not have "catchment areas" in the same sense.) These age-specific admission rates are considerably lower than those to which American investigators are usually accustomed. Her first-admission rates are about 53 per 100,000 population per year. For comparison, in New York City in 1957, Staten Island had a first state mental hospital admission rate of 66 per 100,000 per year, and Manhattan Island one of 180. These contrasts may be due to a number of different factors and are empha-

sized here only to highlight the fact that "mental hospital statistics" represent very different kinds of experience with mental disorders and are not subject to easy glib interpretations.

Dr. Norris was well aware of this fact and went to considerable trouble to unravel some problems in the presentations of her data. One of the important factors affecting admission rates is the population's age distribution. Various devices have been developed to eliminate the effect of differences in age distribution in the population at risk. Dr. Norris' book has a long chapter on computations of "expectations" and "expectancies," a favorite means of psychiatrists for summarizing the mental hospital admissions of a population. This chapter is the best introduction to the concepts of "expectancy" and "expectation" which this reviewer has seen. However, it would appear wiser to pay more attention to age-specific rates when comparing two populations than is usually done. This book gives us a rich supply of new age-specific measures. There are, however, few comparisons of age-specific first-admission rates in different places. These differences are very great.

Indeed, while the contrasts are not as great as between London and New York, there were important differences in the three hospitals within London. Dr. Norris drew attention to these differences, pointed out that there are important differences in the characteristics of the populations being served, and then wisely hesitated to attribute these differences to the differences in economic and social characteristics of the populations in the different catchment areas. She pointed out (quite rightly) that these differences can also be produced by differences in the organization of and utilization of the psychiatric services available to the different populations. Indeed, it would appear that her data throw more light on the variability of psychiatric service practices than on any other single question. Such variations in the organization and use of psychiatric services are referred to in this book as "nosocomial factors," following Svendsen. It is this reviewer's impression that these are not most fruitfully regarded as distorting factors but as the subject of investigation. This is, however, a minority view, and Dr. Norris was following the usual mode of thought

when she described her statistics as data about mental illness (unfortunately influenced by "nosocomial factors") rather than as data about the mode of operation of the psychiatric services. Of course there is some argument for looking upon data referring to the flow of patients into and out of mental hospitals as the product of the cases existing in the population served and of the way in which the psychiatric service functions in relation to that population. However, it would appear that Dr. Norris' data adds to the accumulated experience which suggests that, in practice, a mental hospital can almost always find a much larger number of patients suitable for the care it gives, than it ever does in fact find. If this is true, then, in practice, the hospitals are always selecting patients from a very large potential pool. If that is the case, hospital admission rates and their variations tell us much more about this process of selection than they do about the pool. About all they can tell us about the pool is that it is very much larger than the numbers reported by the hospitals. It would seem to this reviewer that Dr. Norris' data could be examined from this point of view in the light of information about the other characteristics of the hospitals she studied (staffing patterns, ward organization, policies and directives of an administrative nature, and so forth). Such studies could teach us something about the way in which admission rates are affected by styles of organizing and operating mental hospitals. This is another way of saying that the "nosocomial factors" can be investigated rather than lamented.

Dr. Norris began to approach this type of problem when she made the most detailed analysis yet published of the relationship between diagnosis made at an observation unit and diagnosis made at the mental hospital. These data are printed in the appendix and deserve careful study. They are referred to in the text to indicate that psychiatric diagnosis is not just an arbitrary random assignment of labels to cases, and that there is an improbable amount of agreement as between the diagnoses in the different institutions, if that were the case. These tables could undoubtedly be used for more refined analysis of the specific types of disagreements or diagnostic changes which occurred as between units. Had Dr. Norris continued to live

she might well have provided us with a number of papers on this topic. Fortunately, there is enough detail published in these tables so that others can do with her data what she was unable to do.

Follow-up. Some new data are provided on the amount of time spent in mental hospitals following admission for various diagnoses. This is expressed not only in survivorship in the hospital populations but also in the accumulated total of hospital weeks during subsequent readmissions. These figures count time on books of the hospital (whether residing in the hospital, on leave, or on trial) as days of hospital care. This unfortunate tradition in American mental hospital statistics has made analysis of this type of data almost meaningless, but Dr. Norris say that such periods are a trivial matter in her data. On page 22 the following data appear (referring to certified patients only):

On trial for 4 weeks	"some"
Eight weeks	5 per cent
More than 6 months	1 per cent

These facts are of some help in interpreting the length of stay and total duration of hospitalization after admission, but since we are not told whether the long trial patients were bunched in any of the subcategories for which durations are analyzed, we remain more uncertain than necessary of the importance of the variations shown in different age and diagnostic groups. Even so, the data on pp. 134 and 135, justify her pessimistic attitude toward subsequent life outside of hospital for schizophrenics. It would appear that during the few years subsequent to a first admission with this diagnosis, the admission cohorts spent much more time in the hospitals than out. This observation must be taken in conjunction with the fact that half the admissions to these hospitals were discharged within less than nine months after admission. Unfortunately the interpretation of these data is not illuminated in the text by recognition of the concept that excessive hospitalization can be destructive and lead to more hospitalization. Judging from the data made available in the text, the hospitals studied were not examples of newer trends in British and American psychi-

atry towards keeping periods of hospitalization short and minimizing the disability of patients while in hospital. While it is not possible to come to very firm conclusions on the basis provided in this publication, Dr. Norris has added substantially to the devices for looking more closely at the details of hospital patient flow.

This rather lengthy review of a meaty publication does not give a clear picture of the monograph. It gives, at best, some notion of the type of data to be found in the book and some notion of the reviewer's hesitancy in accepting all of Dr. Norris' conclusions. It also suggests, it is hoped, by some examples, the potential usefulness of the data to those with special interests in this field.

ERNEST M. GRUENBERG, M.D., DR. P.H.

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HEREDITY COUNSELING[1]

THIS is a collection of papers presented at a symposium sponsored by the American Eugenics Society. The first part is a discussion of genetics in medical practice by representatives of four fields: pediatrics (J. Warkany), dentistry (C. J. Witkop, Jr.), public health nursing (Helen Dyson, Witkop, and Shirley Butters), and cardiovascular disease (V. A. McKusick). The second part is devoted to genetic counseling with contributions from L. R. Dice, J. V. Neel, C. N. Herndon, F. C. Fraser, F. J. Kallmann, S. C. Reed, C. P. Oliver, H. F. Falls, and W. J. Schull.

As is almost inevitable with its many authors, the book is diffuse, repetitious, and uneven. Many of the ideas will not be new to readers of this journal. But it does put on record the views of an appreciable fraction of the active genetic counselors on this continent, and can be read with profit by anyone interested in the problems of genetic counseling.

Dr. Warkany emphasizes the difficulties of distinguishing

[1] HEREDITY COUNSELING: Edited by Helen G. Hammons. New York: Paul B. Hoeber, Inc., 1959. Pp. xiv + 112. $4.00.

hereditary cases from those due to other causes and points out that even a disease like achondroplasia, a standard textbook example of a dominant trait, is frequently sporadic. He, and several other authors, emphasize the necessity for the best possible diagnosis. Dr. Witkop's article on dentistry is notable for a list of inherited tooth conditions, with the probable mode of inheritance and, of course, a warning that phenocopies are frequent and that not all cases are inherited in the simple fashion indicated. He reports evidence for linkage of dentinogenesis imperfecta and PTC taster based on the paired sib method, which should be checked with more refined procedures. The chapter on public health nursing brings up a number of ideas. The authors point out the value of the nurse in case finding, in adding to the likelihood of successful treatment through early detection, and as the first professional contact for the parents of an affected child. There is an interesting description of the methods used, both in preliminary training of personnel and in actual research on a racially mixed isolate in southern Maryland. Dr. McKusick points out that, although there is considerable detailed knowledge about several individually rare diseases affecting the heart and circulatory system, information on the big killers—congenital malformations, rheumatic fever, hypertension, and atherosclerosis—is only slightly advanced over the stage of saying that "they run in families."

The section on genetic counseling starts with a contribution from Dr. Dice, who draws on his long experience as a pioneer in this field. He discusses the organization of a counseling center and emphasizes the necessity for both diagnostic and genetic competence which can be achieved only by a close cooperation between the geneticists and medical specialists. The same point is made by Warkany, who suggests that counseling be done by a team that includes geneticists, pediatricians, and other specialists "well versed in the diagnosis, variability and nosology of the disorders to be evaluated." He says that for the time being it would seem preferable to have a limited number of clinics (he would call them "parental counseling" clinics) with highly qualified staffs drawn from many disciplines rather than to spread the available talent too thin. A similar point is made by Schull who is concerned with the problem of poor advice.

He notes that "man has done fairly well for a good many thousands of years in the absence of genetic counseling" and suggests that we can afford to wait for 10 or 20 years until there is adequate personnel rather than do an incompetent job now.

There is an informative discussion of empirical risks by Neel. He points out that they are no substitute for exact etiological information, but they do provide a useful first stage. He also notes the importance of refining risks for different subsets of the population; for example, parental age might be considered in some risk figures. I would add that number of affected sibs should be considered, and in many cases the total size of sibship, which may offer evidence on whether an isolated case is a segregant from carrier parents or sporadic.

Dr. Kallmann discusses the personal problems in genetic counseling, and emphasizes the necessity for tact and empathy with the person seeking advice. Dr. Falls urges consideration of the person and the family, and not just the disease entity in giving genetic advice. Herndon discusses methods of referrals. He urges the importance of written records and strict observance of medical ethics. He points out some hazards of counseling by mail or telephone, particularly the problem of wrong diagnosis. Reed says that most genetic counseling in the future will be done by physicians; ergo, physicians should have better training in genetics.

That genetic counseling is yet an imperfect art is abundantly brought out. Almost all the authors point out difficulties. There is as yet no standardization of organization for heredity counseling. What should be the financial support? Should there be a charge for advice? How are the mechanics of referrals handled? Should there be counseling by mail or by phone? Should the counselor see the patient directly, or should he counsel through the physician? In general what are the moral and legal responsibilities of a counselor? To what extent is he liable to malpractice charges, or responsible for bad advice or for diagnostic errors? How far beyond stating probabilities and risks should he go in his discussions with the prospective parent?

It is no criticism of the book, but a comment on the present

stage of development of this potentially important branch of medical genetics to say that after having read the book the reader will find himself with many more questions than answers.

JAMES F. CROW

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BUILD AND BLOOD PRESSURE[1]

NEW evidence that large variations in mortality are associated with body weight and with blood pressure is provided by the findings published by the Society of Actuaries in Volume One of BUILD AND BLOOD PRESSURE, 1959. The unfavorable effect of excess weight and of elevated blood pressure on health has been widely recognized for a number of years, very largely as a result of earlier studies by the Society of Actuaries. Insurance companies have a unique opportunity to study mortality over a period of years among large populations of policy holders for whom various individual characteristics are available, such as weight and medical impairments. This latest statistical analysis of mortality from 1935 to 1954 not only provides data on recent mortality experience for several million persons but also furnishes up to date measures of height, weight, and blood pressure. The findings no doubt will be carefully studied by professional personnel in the health field for significant implications to programs for promoting better health.

The study is based on the mortality experience of persons aged 15 to 69 years to whom Ordinary standard policies were issued in the years 1935 to 1953, except that in the build study policies substandard only because of weight are included and in the blood pressure study, those substandard only because of blood pressure are included. Data for persons with selected minor impairments who were eligible for standard insurance are included. The analysis is done separately for this group and the relation of specific impairments to variations in mortality according to build is shown. The population for whom

[1] BUILD AND BLOOD PRESSURE STUDY 1959. Vol. 1. Society of Actuaries.

records were assembled, the data on build and blood pressure and that on minor impairments are described in detail in the report. It is the opinion of the authors that this insured population includes a sizable proportion of wage earners and a representative portion of the later immigrant stocks, whereas in earlier studies, the bulk of the population was in the middle and upper economic groups.

Mortality experience is expressed throughout the report as a ratio of the reported deaths among any group of policy holders to the expected number of deaths estimated from a Basic Table of Mortality Rates for 1935–1954 according to "Age at Issue" and "Policy Years." This Basic Table was developed from insurance mortality experience for men and women combined and is used for estimating expected deaths for each sex. It is so predominately weighted by mortality of men that the mortality ratio for the male population in the study on build is 99. For the total female population, however, the ratio is 60, and decreases from 74 at ages 20 to 29 to 51 and 53 at ages 50 to 59 and 60 to 69. Consequently, the mortality ratios compared for subgroups of men classified by build or other characteristic have a relative variation centering around approximately 100. But for women, the relative variation must be judged with reference to a base ratio as low as 50 for older women. This can be misleading unless careful attention is given to the percentage variation of the mortality ratio for a specific subgroup from the ratio for the compared subgroups. For example, for men aged 40 to 69 in the most overweight group (V) with 1 to 19 policy years, the mortality ratio is 137 compared with 94 for men in the normal weight group (II) (page 79). For women in these subgroups, the mortality ratios are 72 and 49 (page 82). This represents a 46 percentage excess in mortality for the overweight men, and a 47 percentage excess for overweight women, although the differences in percentage points are 43 and 23 for men and women, respectively. The authors of the report were fully cognizant of this problem, of course, and it is mentioned here only because of its importance to any comparisons of effects of weight or blood pressure on mortality among men and women, and to comparisons of variations in mortality for younger and older women.

The scope of this mortality investigation may be indicated by listing the major characteristics of the population for which variations in mortality are examined. Mortality ratios in the build study are given for: (1) specific weight-height classifications by sex and age at issue, and five "build" classifications by sex and age at issue and by sex and policy year durations since issue for (a) persons without known minor impairments, (b) persons with minor impairments and (c) total with and without minor impairments, including persons whose status was not determined; (2) cause of death for broad weight-height groups; (3) obese persons, weight exceeding 254 pounds; (4) groups with specific minor impairments classified by build and age, and by build and "policy years"; (5) specific weight-height classifications for persons issued substandard policies because of overweight who subsequently had standard insurance because of weight reduction. In the blood pressure study, mortality ratios are given for: (1) specific systolic-diastolic blood pressures classified by sex and age for persons with and for persons without known minor impairments, and for the total including those for whom minor impairment status was unknown; (2) specific causes of death among men and among women classified by age and by broad systolic-diastolic blood pressure groups; (3) groups with specific minor impairments classified by systolic blood pressure and by diastolic blood pressure and by age at issue and policy years since issue. A separate analysis of the mortality experience of men and women classified as substandard risks because of excess weight is made according to age at issue of policy and blood pressure at that time.

The major variations in mortality associated with height, weight, build (weight for height), blood pressure levels and minor impairments and the interaction of these factors by sex and age are summarized in the report. Obviously, it is not possible to review them, but a careful reading of this well-prepared text is both necessary and interesting to anyone desirous of understanding the findings from this investigation. In the discussion of comparisons of the current study with the two earlier intercompany investigations of build and mortality (experience on issues of 1885 to 1908 and on issues of 1885 to

1927), the authors summarize major findings concerning build and mortality as follows: (page 95)

> The major changes in mortality among men according to build are the relative improvement for tall men at most ages and the relative worsening for short men at most ages. . . . Comparisons . . . for specific weight ranges according to height show a somewhat mixed picture. The most consistent change is the decline in the mortality ratios for tall underweights, especially at ages under 40, and the increase in the mortality of short overweights at most ages. . . . All three studies bring out the clear-cut disadvantage of overweight—mortality ratios rising in every instance with increase in degree of overweight.

With such a large experience for mortality in relation to height and weight and to blood pressure, up to date tables for desirable weight and the most favorable blood pressure can be prepared. This has been done for weight by the Metropolitan Life Insurance[2] which has published "New Weight Standards for Men and Women" to replace the former tables of "Ideal Weights for Women" and "Ideal Weights for Men" which have been very widely used. Data from the BUILD AND BLOOD PRESSURE STUDY show that mortality was most favorable for persons who were below average weight for height and age and also that average weights for women are now less than those obtained from earlier studies but for men tend to be somewhat higher. In the new standards of weight, the upper limits of weight for men have been changed very little but the range has been widened. For women, the upper limit of desirable weight has been reduced 5 or 6 pounds for the medium frame category and the range also widened. The consistency of the evidence that even a moderate degree of overweight is unfavorable makes it clear that weight control is an important health problem even for those who are free of impairments. It is encouraging to find that the mortality of overweights who reduced was in general comparable with that of standard risks.

DOROTHY G. WIEHL

[2] *Statistical Bulletin*, Metropolitan Life Insurance, November-December, 1959.

THE POPULATION OF THE UNITED STATES[1]

Having gained top recognition in several fields such as internal migration, economic areas, and metropolitan areas, Bogue refuses to be stereotyped as a specialist and has now written a large and comprehensive volume, The Population of the United States.

According to the author "this book has two major objectives: (1) to describe and interpret the population changes in the 1950 to 1960 decade, insofar as it is possible to do so in advance of the 1960 Census, and (2) to summarize the available population knowledge about recent changes and historical trends in each of the leading fields of population anlysis." (pp. iii–iv) The author has accomplished these purposes well by a thorough analysis of not only regular census data but also of post-censal inquiries, surveys, and of recent secondary sources.

The book is divided into three unnamed parts. Part I consists of five chapters on growth and distribution of the population, by urban-rural residence, metropolitan and non-metropolitan residence, and states, regions, geographic divisions, and economic areas.

Part II consists of chapters 6–20 and is devoted to (a) composition of the population by age, sex, nativity and color, marital status, household and family status, school enrollment, labor force, occupation, industry, and income, and (b) the components of population change: mortality, fertility, international migration, and internal migration. The chapter on fertility is an excellent one, contributed by Wilson A. Grabill of the Bureau of the Census.

Part III contains chapters 21–26 and is devoted to miscellaneous subjects: population in institutions, illness, religious affiliation (essentially a type of composition), housing, Alaska and Hawaii, and future population of the United States.

The author apparently tried to reach two types of audience. Bowing to the laymen, he states "This book is a product of the belief that a considerable number of people need and want, within the covers of a single book, a comprehensive statement

[1] Bogue, Donald J.: The Population of the United States, Glencoe, Illinois: The Free Press, 1959, 873 pp., $17.50.

of population events, together with an explanation of how and why they are taking place. Although such a book should not be oversimplified by the omission of fundamental information, it should spare the interested but statistically untrained reader elaborate explanations of many technical details that have little effect on his understanding of the results." (p. iii) Turning attention next to the textbook market, he explains that the materials were "organized according to the outline followed by the writer teaching a course, with this same title, at the University of Chicago." (p. iv)

In keeping with the author's bid to the laymen, the book has range and breadth rather than depth. The reviewer found two rather unfortunate typographical or editorial errors. A table on page 788 puts the 1950 world population at 1,497 millions instead of 2,497 millions. A table on page 790 has the term "millions" rather than the correct term "thousands" at the top of the relevant columns. However, in this reviewer's opinion the book is a valuable one. In fact, he ventures the prediction that the author's overtures to the classroom and his professional peers will be more successful than his wooing of the general reader.

Clyde V. Kiser

BOOKS

In Collaboration with the Milbank Memorial Fund

Approach to the Prevention of Disability from Chronic Psychoses, an: the open hospital within the community. 1957 Annual Conference of the Milbank Memorial Fund, 1958. 80 pages. $1.00.

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Current Research in Human Fertility. 1954 Annual Conference of the Milbank Memorial Fund, 1955. 163 pages. $1.00.

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Family Health Maintenance Demonstration, the. a controlled, long-term investigation of family health. Proceedings of a Round Table at the 1953 Annual Conference of the Milbank Memorial Fund, 1954. 251 pages. [illegible]

Interrelations between the Social Environment and Psychiatric Disorders. 1952 Annual Conference of the Milbank Memorial Fund, 1953. 268 pages. $1.50.

Interrelations of Demographic, Economic and Social Problems in Selected Underdeveloped Areas, the. Proceedings of a Round Table at the 1953 Annual Conference of the Milbank Memorial Fund, 1954. 200 pages. $1.00.

Nature and Transmission of the Genetic and Cultural Characteristics of Human Populations, the. 1956 Annual Conference of the Milbank Memorial Fund, 1957. 144 pages. $1.00.

Nutrition in Relation to Health and Disease. 1949 Annual Conference of the Milbank Memorial Fund, 1950. 252 pages. $1.00.

Planning Evaluations of Mental Health Programs. 1957 Annual Conference of the Milbank Memorial Fund, 1958. 104 pages. $1.00.

Programs for Community Mental Health. 1956 Annual Conference of the Milbank Memorial Fund, 1957. 224 pages. $2.00.

Progress and Problems of Community Mental Health Services. 1958 Annual Conference of the Milbank Memorial Fund, 1959. 232 pages. [illegible]

Promotion of Maternal and Newborn Health, the. 1954 Annual Conference of the Milbank Memorial Fund, 1955. 229 pages. $1.50.

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Social and Psychological Factors Affecting Fertility, Volumes II, III, IV and V. New York: Milbank Memorial Fund, 1950, 1952, 1955, and 1958. $1.00 each.

Thirty Years of Research in Human Fertility: Retrospect and Prospect. 1958 Annual Conference of the Milbank Memorial Fund, 1959. 158 pages. $1.00.

Trends and Differentials in Mortality. 1955 Annual Conference of the Milbank Memorial Fund, 1956. 168 pages. $1.00.

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